Indebted Supply and Monetary Policy: A Theory of Financial Dominance*

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Abstract

We develop a New Keynesian model with financial frictions to study how corporate capital structure shapes static and dynamic monetary policy tradeoffs through the supply side. Ex post, when corporate leverage is high, monetary tightening contracts both demand and supply. As a result, the Phillips curve is highly non-linear and state-dependent, and the "natural rate" R^n ensuring price stability increases with corporate leverage. Yet the tradeoff between inflation targeting and tightening supply constraints implies that the optimal ex-post policy is to set a rate $R^{opt} < R^n$ that can *decrease* with leverage. Ex ante, firms' market-timing incentives lead them to increase leverage when rates are low, which creates an *intertemporal* tradeoff: monetary easing supports current demand but hurts future supply, which makes easing partially self-defeating. The optimal ex-ante monetary policy features a prudential motive for leaning against leverage even when the divine coincidence holds in the current period.

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1 Introduction

Recent economic events, including the Global Financial Crisis of 2008, the COVID-19 pandemic, and the subsequent inflationary pressures, have highlighted significant gaps in our understanding of the intricate relationship between monetary policy, financial markets, and the real economy. One crucial aspect that standard models often overlook is the role of corporate capital structure and financial constraints in shaping central banks' ability to respond to macroeconomic shocks. We fill this gap by exploring how corporate financial choices can constrain conventional monetary policy and alter its transmission mechanisms.

We use the term "financial dominance" to refer to situations in which inherited corporate balance-sheet conditions limit the central bank's ability to achieve its macroeconomic objectives through their effect on aggregate supply. Unlike fiscal dominance, where the constraint stems from government debt and typically requires assuming the central bank internalizes public solvency, financial dominance operates through the standard inflation-output tradeoff: corporate leverage directly affects natural output and therefore the Phillips curve faced by policymakers.

Our analysis identifies two distinct channels through which corporate leverage constrains monetary policy, with two corresponding policy implications. First, *ex post*, outstanding corporate debt makes aggregate supply sensitive to the policy rate. When inherited leverage is high, monetary tightening forces financially constrained firms to scale down production, contracting supply alongside demand. A higher rate is required to restore price stability after inflationary shocks, and the Phillips curve becomes kinked in a way that depends on the inherited balance-sheet state. The Ramsey-optimal policy therefore faces a static tradeoff between standard New Keynesian objectives (closing the output gap and eliminating price dispersion) and avoiding the additional supply contraction caused by tighter financial constraints. This generates an endogenous tolerance for inflation that grows with debt: in high-leverage states, the inflation-targeting rate rises with outstanding leverage, but the welfare-optimal rate can fall.

Second, *ex ante*, monetary policy affects firms' capital structure choices through a *market-timing* motive. When monetary easing disproportionately lowers the cost of debt relative to equity, firms optimally increase leverage, which tightens future supply constraints. This makes future natural output a function of current policy, creating a new intertemporal tradeoff even in environments where a static analysis would suggest a divine coincidence. Optimal policy therefore features a prudential motive to lean against leverage creation: absent targeted macroprudential tools, the Ramsey planner accepts more contemporaneous slack to preserve future supply capacity.

To explore these ideas, we develop a tractable New Keynesian model with financial frictions that captures rich interactions between monetary policy, firms' capital structure decisions, and macroeconomic outcomes. We introduce two novel ingredients that are crucial for understanding the concept of financial dominance. First, firms face limited pledgeability at the production stage: at the outset of the production period they cannot credibly issue claims backed by operating cash flows, so short-run production expenditures must be financed by debt backed by pledgeable assets. Second, firms can choose at the investment stage between external debt and more expensive external equity, creating a market-timing motive driven by the relative cost of debt and equity.

We then show that the Phillips curve becomes "kinked" when firms are highly levered: at low interest rates, firms have sufficient pledgeable income left (or their assets have a sufficient collateral value) to produce at full scale, but high interest rates force indebted firms to scale down production in response to binding financial constraints. The kinked Phillips curve leads to our first notion of financial dominance: outstanding corporate debt worsens the central bank's inflation-output tradeoff and amplifies the costs of inflationary pressures arising from positive demand shocks or negative supply shocks. When firms are indebted, the "divine coincidence" breaks down and it becomes impossible to stabilize both output and inflation. Maintaining output at its potential comes at the cost of high inflation, while taming inflation requires a severe contraction in output. Our framework does not imply that higher rates are inflationary, as the negative effect of rates on aggregate demand still dominates; but we show that a larger outstanding corporate debt burden implies that a higher policy rate—and thus a more severe contraction in output—are required to maintain price stability in the face of inflationary pressures. Since, as explained above, the state of corporate balance sheets is in part determined by past interest rates, the location of the kink in the Phillips curve, and thus the inflation-output trade-off faced by the central bank, depend on the path of prior interest rates. Conversely, inflationary shocks dissipate in part thanks to a dynamic adjustment of corporate leverage. Keeping the policy rate high allows the kink in the Phillips curve to shift back to its original position.

Our second notion of financial dominance highlights that monetary easing, for instance aimed at stimulating the economy following negative demand shocks, can lead to a "leverage boom" that weakens the current expansionary effects and constrains future policy options. Monetary easing today sows the seeds for future financial constraints, as low rates induce a rise in corporate leverage with the potential for indebted supply in the future. This reduces the effectiveness of monetary policy in stimulating output, because the anticipation of future financial distress undermines the current response of aggregate demand to interest rates (through standard intertemporal substitution or wealth effects). As a result, in response to large negative demand shocks, the central bank needs to ease policy more aggressively than in standard models to achieve the same output stabilization. However, this comes at the cost of a lower future productive capacity. The central bank's dilemma is between cutting rates aggressively at the cost of a slower recovery, and restricting easing to prevent aggregate supply from becoming indebted.

These findings have important implications for our understanding of historical episodes and current policy challenges. For instance, our model can help explain how the prolonged period of low interest rates and high corporate leverage following the Global Financial Crisis made the subsequent normalization of monetary policy so challenging for many central banks. Moreover, our results speak to the more recent debate on the appropriate monetary policy response to supply chain disruptions and inflationary pressures in the wake of the COVID-19 pandemic. The model suggests that the severity of the policy tradeoff was shaped by leverage accumulated during the preceding easing cycle.

Related literature

Our work builds on the extensive literature on the macroeconomic implications of financial frictions, pioneered by Bernanke and Gertler (1989) and Kiyotaki and Moore (1997). This work, further developed by Bernanke, Gertler and Gilchrist (1999), emphasizes how firms' balance sheet conditions can amplify and propagate macroeconomic shocks. While these seminal papers focus on how net worth affects firms' ability to borrow, our model introduces a novel mechanism whereby firms choose between different forms of external finance and past capital structure decisions directly constrain their current production capacity.

Our work is also closely related to the literature on the "cost channel" or "working capital channel" of monetary policy, as developed by Barth and Ramey (2001), Christiano, Eichenbaum and Evans (2005), and Ravenna and Walsh (2006). These papers highlight how interest rates directly affect firms' costs when they need to borrow to finance inputs (often focusing on wages) before production, but feature no interaction between long-term debt financing investment and the short-term working capital loans. Our model builds on this insight but introduces two key innovations. First, in our framework, the relevance of the cost channel depends endogenously on firms' past capital structure decisions: firms' productive capacity only suffers from higher rates if outstanding debt is high.[1] Second, we show how current monetary policy affects the future strength of the cost channel through its impact on firms' leverage choices.

We also contribute to the literature on corporate finance and monetary policy. In Graham and Harvey (2001)'s influential survey, firms report that the level of interest rates is an important driver of firms' decision to issue debt. Firms try to time the market by issuing debt when they believe interest rates are particularly low, and by issuing more short-term debt when short-term rates are low relative to long-term rates. This parallels the market timing theory of capital structure driven by fluctuations in asset prices (e.g., Baker and Wurgler, 2002; Ma, 2019). Baker, Greenwood and Wurgler (2003) and Greenwood, Hanson and Stein (2010) provide evidence that corporate debt maturity responds to movements in the yield curve, connecting these findings to fiscal policy and the maturity of government debt. Our model formalizes the macroeconomic and dynamic consequences of this market-timing motive, and focuses on implications for monetary policy.

Our paper also relates to the extensive literature on the nexus between monetary policy and financial intermediaries. Adrian and Shin (2010), Borio and Zhu (2012) and Farhi and Tirole (2012) focus on how low interest rates, or the anticipation thereof, may induce excessive risk-taking by financial intermediaries causing future financial instability. We argue, using a framework closer to the canonical New Keynesian analysis of monetary policy, that low rates can lead to higher corporate leverage and worsen the future inflation-output tradeoff and monetary policy effectiveness. Another strand of the literature focuses on various manifestations of the "bank lending channel" describing how bank credit supply responds to monetary policy (Bernanke and Blinder, 1988; Kashyap and Stein, 2000; Drechsler et al., 2017). In particular, Drechsler, Savov and Schnabl (2022) argue that tight monetary policy in the 1970s combined with a regulatory cap on deposit rates (Regulation Q) led to stark deposit outflows and credit crunches, ultimately hurting aggregate supply.[2]

Recent work has emphasized the path-dependent effects of monetary policy operating through the household sector. Berger, Vavra, Milbradt and Tourre (2021) and Eichenbaum, Rebelo and Wong (2022) highlight how past interest rate decisions affect current policy effectiveness through mortgage refinancing incentives: a given rate cut is less expansion-

[1] Jermann and Quadrini (2012) also model firms facing a financial constraint that jointly limits debt contracted at different periods (intertemporal long-term debt and interest-free intraperiod working capital loans). In our model, financial dominance arises because new borrowing is not interest-free but subject to the new policy rate.

[2] Our baseline model abstracts from financial intermediaries. In Section A.5 we extend our framework to incorporate bank-driven credit supply shocks.

ary if a large share of mortgages have already been refinanced in response to recent cuts. McKay and Wieland (2021) show that monetary policy has "limited ammunition" because any past durable purchases induced by monetary easing crowd out future durable consumption. Mian, Straub and Sufi (2021) emphasize the key role of *household balance sheets* and show that aggregate demand can become "indebted" in response to low rates in a model when borrowers and savers have different marginal propensities to consume. High household debt then dampens the effect of future rate cuts on aggregate consumption. Our paper complements this literature by focusing on *corporate balance sheets*, showing how past interest rates affect future policy space through their impact on firms' "indebted supply".[3]

Finally, our work contributes to the literature on how firm heterogeneity affects monetary policy transmission. Ottonello and Winberry (2020) study how firms' leverage and credit risk affect their investment response to monetary shocks, while Jeenas (2024) emphasizes the role of corporate liquidity. Our model differs by focusing on how leverage affects firms' production decisions rather than just investment, and by examining the implications of these dynamic effects for monetary policy. Cloyne, Ferreira, Froemel and Surico (2023) document a strong impact of monetary policy on young firms' investment working through collateral values, consistent with our model's mechanism.[4]

Roadmap of the analysis. The remainder of the paper is organized as follows. Section 2 presents our baseline model of production and capital structure decisions in the presence of financial frictions. We then proceed in two steps that correspond to two notions of financial dominance.

Ex-post analysis (Section 3): Taking outstanding corporate debt as given, we show that monetary tightening can force financially constrained firms to scale down production, contracting supply alongside demand. The Phillips curve becomes kinked at an endogenous threshold that varies with inherited leverage, creating a path-dependent inflation-output tradeoff. We derive the optimal ex-post monetary policy, that trades off standard New Keynesian objectives (price stability and no output gap) against the effect of rates on firms' financial constraints.

Ex-ante analysis (Section 4): Endogenizing leverage, we show that monetary easing can

[3] Jiménez, Kuvshinov, Peydró and Richter (2023) study the interaction between monetary policy paths and financial instability using international historical data. They find that rate cuts lead to credit booms that leave the banking sector vulnerable to future rate hikes. This pattern is consistent with our mechanism, although we focus on the capital structure of nonfinancial firms.

[4] More broadly, Chaney, Sraer and Thesmar (2012) show how real estate prices affect corporate investment through a collateral channel.

induce firms to tilt their capital structure toward debt ("market timing"), which in turn tightens *future* supply constraints. This creates an intertemporal policy tradeoff even when the divine coincidence holds in the current period: even if the central bank succeeds at stabilizing output and inflation today, it may do so by creating a more fragile supply side tomorrow. Optimal policy therefore features a prudential motive to lean against leverage: in response to large negative demand shocks, the central bank tolerates some contemporaneous slack to preserve future supply capacity.

2 Model

This section introduces our model of production and capital structure decisions of firms in the presence of two financial frictions: limited pledgeability of cash flows, and differences in the expected returns on different claims in the capital structure that generate a market-timing motive.

These financial frictions lead to the following central tradeoff regarding capital structure. Each firm must fund an initial fixed investment outlay and a subsequent variable one that determines its production capacity. The former can be funded with debt and more expensive equity, while the latter can only be funded with debt. Firms thus face a tradeoff between minimizing the cost of initial investment with a high initial leverage, and sparing borrowing capacity to maximize scale at $t+1$.

Preferences. The economy is populated by a representative household with preferences over streams of consumption and labor $\{C_t, N_t\}_{t\geq 0}$:

$$\sum_t \beta^t \left(\log C_t - \chi N_t\right), \tag{1}$$

where $\beta \in (0,1)$ and $\chi > 0$.[5] Throughout the analysis of date-0 demand shocks, we allow for a transitory shock to the discount factor between periods 0 and 1. Specifically, we replace the constant β with a sequence $\{\beta_0, \beta, \beta, \ldots\}$. A fall in β_0 relative to β represents a positive demand shock (households become more impatient to consume at date 0), while a rise in β_0 represents a negative demand shock. The date-0 Euler equation is $\beta_0 R_0 C_0 = C_1$, while for $t \geq 1$ the standard Euler equation $\beta R_t C_t = C_{t+1}$ applies.

[5] We assume a unit elasticity of intertemporal substitution to simplify expressions but it is straightforward to allow for more general CRRA preferences, cf. Appendix A.8.

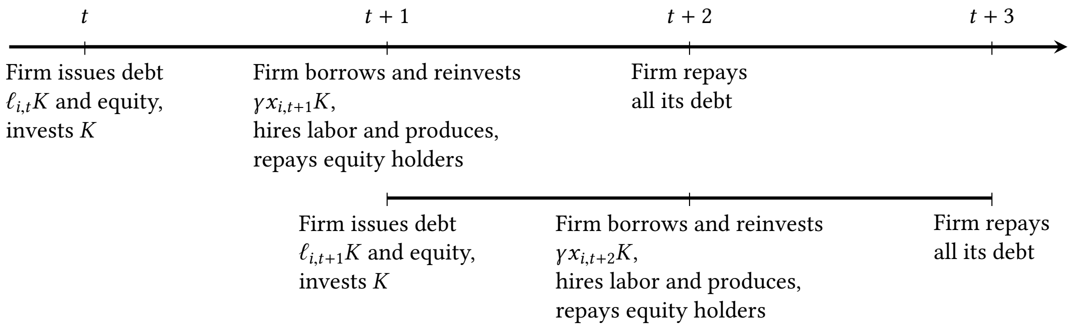

Figure 1: Timing of investment and production for firms born at t and $t+1$.

The final consumption good combines a continuum of varieties indexed by $i \in [0,1]$ according to a constant elasticity of substitution (CES) aggregator

$$C_t = \left(\int_0^1 C_{i,t}^{1-1/\epsilon} di \right)^{\frac{\epsilon}{\epsilon-1}}, \tag{2}$$

where $C_{i,t}$ is the consumption of variety i and $\epsilon > 1$ is the elasticity of substitution between varieties. The only purpose of introducing differentiated varieties is to model nominal rigidities later as in the standard New Keynesian model. Equivalently, we could assume that varieties correspond to intermediate goods that are combined into the final consumption good C_t by competitive firms.

Production technology. There are overlapping generations of firms present for three periods, as depicted in Figure 1. Each variety $i \in [0,1]$ is produced at date $t+1$ by a firm set up at the previous date t as follows. Entry entails an initial real investment outlay $K > 0$ at date t. At date $t+1$, the firm must spend an additional amount $\gamma_{i,t+1} x_{i,t+1} K$ before generating any operating income, where $x_{i,t+1} \in [0,1]$ is the firm's continuation scale. The expenditure shocks $\gamma_{i,t+1}$ are i.i.d. across firms, distributed according to the c.d.f. $\Gamma(\cdot)$ with compact support in $[0,+\infty)$. To simplify the exposition, in the main text we focus on the case of a degenerate distribution, with $\gamma_{i,t+1} = \gamma$ for all firms, i.e., a deterministic expenditure need. We discuss below how our results extend to the more realistic case of a stochastic γ.

Our model of liquidity shocks is in the spirit of Holmström and Tirole (1998). The expenditure needs could be interpreted as working through the cost of inputs necessary to production (e.g., materials, energy, or inventories) or a productivity shortfall (e.g., failing projects) that can be partly offset with new investments. A higher need γ means that more funds are required to produce a given amount at $t+1$. If the firm is unable to raise a sufficient amount from investors at $t+1$, it needs to reduce its continuation scale $x_{i,t+1}$.

The expenditure $\gamma_{i,t+1}x_{t+1}K$ is not produced by the same financially constrained firms, but takes the form of a different good, e.g., an input produced by competitive "wholesalers" as in the working capital literature (Christiano, Eichenbaum and Evans, 2005). As a result, a lower continuation scale x_{t+1} induced by binding financial constraints will act as a pure supply shock, that is, a contraction in the productive capacity but not in the demand for each variety's output. In Section A.4, we relax this assumption so that a share of the reinvestment $\gamma_{i,t+1}x_{t+1}K$ is produced by sticky-price firms. In that case, a lower x_{t+1} acts simultaneously as a negative supply shock and a negative demand shock.

Given a continuation scale $x_{i,t+1}$, the firm can hire $N_{i,t+1}$ units of labor to produce

$$Y_{i,t+1} = Ax_{i,t+1}^{\nu}K^{\alpha}N_{i,t+1}^{1-\alpha}$$

units of its variety, where $A > 0$ is the total factor productivity and $\alpha, \nu \in (0,1)$. When $x_{i,t+1} < 1$, the firm scales down relative to its full capacity. For clarity, we assume that the labor hiring decision is not subject to financial constraints, unlike in the "cost channel" literature.

Finally, at date $t+2$, the firm generates a final real cash flow worth K units of the final good before exiting. One simple interpretation is that K is an initial capital investment (e.g., land or real estate as in Kiyotaki and Moore 1997) that does not depreciate and can be resold after production; alternatively, K can be viewed as a cash flow that is not subject to any informational friction and is thus fully pledgeable to outside investors.

Financial frictions. Each firm is owned by a single household who is a residual claimant on its cash flows but with negligible resources relative to the needs of the firm. Therefore, firms need to raise external funds to fund their initial investment and subsequent expenditures. They do so subject to the following financial frictions:

1. At both dates (t and $t+1$), firms can issue "debt" securities, backed by the terminal value K, with a required return R_t between t and $t+1$. Initial claims issued at t cannot be diluted at $t+1$.

2. At the initial date t, and only at that date, firms can issue "equity" securities, backed by all cash flows (including date $t+1$ operating profits), with a required return R_t^E.

Throughout, we use "debt" to refer to claims backed by pledgeable assets (the terminal value K), which includes secured debt, senior unsecured debt with anti-dilution covenants, and short-term debt that can be rolled over (Smith and Warner, 1979; Donaldson et al., 2022). We use "equity" to refer to claims backed by operational cash flows.[6] This encompasses not only traditional equity but also junior or mezzanine debt and any cash-flow-based claims subject to the informational frictions described above.

In other words, firms can issue perfectly liquid debt at any time but cannot use their entire cash flows to back it. Encumbering assets early on can restrict future continuation. By contrast, their operating profits can back equity claims that can only be sold at the outset and command a higher return, which captures that equity is a less liquid form of external finance than debt. For instance, the date-$t+1$ operating cash flows could become more difficult to pledge if insiders receive private information over time.[7] The lumpy issuance concentrated at date t can be thought of as stemming from fixed costs of equity issuance as in Hennessy and Whited (2007) and Bolton, Chen and Wang (2011)—motivated by empirical and theoretical work on the pecking order theory dating back to Myers and Majluf (1984)—or infrequent access to equity markets as in, e.g., Hugonnier, Malamud and Morellec (2014) and Hartman-Glaser, Mayer and Milbradt (2022).

Nominal rigidities. Prices are set one period in advance, and can only be revised for a fraction of the firms.

When firms are first set up at date t, they quote a price $\bar{P}_{i,t}$ for their date-$t+1$ output at date t. At date $t+1$, after observing any aggregate shock and choosing the continuation scale $x_{i,t+1}$, they get to set a new price $P^*_{i,t+1}$with probability $\lambda \in [0, 1)$ where $\lambda < 1$. Firms always accommodate the demand they receive.

Under perfect foresight, the price set in advance by firms born at date t equals the ex-post optimal flexible price, $\bar{P}_{i,t} = P^*_{i,t+1}$, hence $\mathbf{E}_t \Pi_{i,t+1} = \Pi^*_{i,t+1}$. As a result, in this formulation, nominal rigidities will only be relevant at $t = 0$ when unanticipated shocks (to fundamentals or to monetary policy) occur.

[6] It will indeed be optimal for firms to pledge the entire date-$t+2$ value K to "debt" investors, thus making the equity investors residual claimants.

[7] In Appendix A.7, we model the impossibility to pledge operational cash flows at the outset of date $t+1$ as resulting from such a lemons problem. Some firms privately observe that they are unable to produce at date $t+1$, while productive firms have no credible way to signal their quality to investors at this point. When seeking to issue claims against their operational cash flows, they are mimicked by the unproductive ones, and so they must face a prohibitive adverse-selection discount that makes the equity issuance unprofitable.

Monetary policy. The central bank sets a nominal interest rate i_0 at $t = 0$. Given the nominal rigidities, for any real rate R_0 there is a nominal interest rate i_0 such that the equilibrium real rate is equal to R_0. Thus it is without loss of generality to assume that the central bank controls the real rate R_0 directly.

Equilibrium. Given the initial outstanding debt $F_{-1} = R_{-1}\ell_{-1}$, a sticky prices equilibrium corresponds to sequences of allocations and prices

$$\left\{C_t, Y_t, x_t, \ell_t, N_t, W_t, P_t, R_t, R_t^E\right\}_{t\geq 0}$$

such that households choose $\{C_t, N_t\}$ to maximize (1) subject to their budget constraints, each firm i born at t chooses $(\ell_{i,t}, x_{i,t+1}, \bar{P}_{i,t}, N_{i,t+1})$ to maximize expected profits under monopolistic competition subject to their financial constraints and is able to reset its price at $t+1$ with probability λ, and all markets clear.

The household side is standard. We assume complete risk sharing between the households who own a firm and those who don't, so that all households share the same consumption level C_t. Given a gross interest rate R_t between t and $t+1$, households' Euler equation for the liquid asset (debt) is given by

$$\beta R_t C_t = C_{t+1}. \tag{3}$$

Optimal labor supply yields

$$\frac{W_t}{P_t} = \chi C_t \tag{4}$$

where W_t is the nominal wage and P_t is the aggregate price level.

Given prices $\left\{P_{j,t}\right\}_{j\in[0,1]}$, the CES aggregator (2) implies a standard isoelastic demand for each variety i:

$$C_{i,t} = C_t\left(\frac{P_{i,t}}{P_t}\right)^{-\epsilon}$$

where P_t is the price index satisfying $P_t = \left(\int_0^1 P_{j,t}^{1-\epsilon}dj\right)^{\frac{1}{1-\epsilon}}$.

3 Indebted Supply

This section studies the *ex-post* monetary policy problem taking inherited corporate leverage as predetermined. The key mechanism is "indebted supply": outstanding encumbering claims reduce firms' remaining debt capacity, so a monetary tightening can force financially constrained firms to operate at a lower continuation scale. With nominal rigidities, this supply sensitivity to the policy rate affects the inflation-output tradeoff faced by the central bank.

We proceed in three steps. First, we solve firms' pricing decisions conditional on a continuation scale. Second, we characterize the continuation scale implied by the inherited leverage state and the current policy rate. Third, we combine these elements to obtain the Phillips curve and solve for the ex-post Ramsey-optimal policy. Section 4 then endogenizes leverage and introduces the intertemporal channel operating through market timing.

3.1 Ex-post equilibrium

Firms' pricing. Given a continuation scale $x_{i,t}$ and aggregate variables (P_t, W_t, Y_t), a generation-$(t-1)$ firm i that can reset its price at t chooses $P^*_{i,t}$ to maximize its real profits $\Pi_{i,t}$:

$$\Pi_{i,t} = \frac{P_{i,t}Y_{i,t} - (1-\tau)W_t N_{i,t}}{P_t},$$

where τ is a labor subsidy (financed lump-sum) commonly used in New Keynesian models to offset the steady-state monopoly distortion. In this notation, $\Pi_{i,t}$ does not include the reinvestment cost $\gamma x_{i,t}K$, which is sunk at the time the firm sets its price. Thus at the end of period t the resources left in the firm (i.e., real profits net of any reinvestment costs) are equal to $\Pi_{i,t} - \gamma x_{i,t}K$.

The optimal reset price follows from standard monopolistic competition with decreasing returns to scale:

Lemma 1 (Optimal pricing)**.** *The optimal relative price $p^*_{i,t} = P^*_{i,t}/P_t$ of a firm with continuation scale $x_{i,t}$ is*

$$p^*_{i,t} = \left[\left((1-\tau)\frac{\epsilon}{\epsilon-1}\right)^{(1-\alpha)}\left(\frac{Y_t}{x^{\nu}_{i,t}\bar{Y}}\right)\right]^{\phi}, \tag{5}$$

where we define $\phi = 1/(1+(\epsilon-1)\alpha) \in [0,1]$ and

$$\bar{Y} = AK^{\alpha}\left(\frac{1-\alpha}{\chi}\right)^{1-\alpha} \tag{6}$$

Equation (5) shows the standard characterization of the optimal price set at a markup over marginal cost. The only part that is specific to our model is that a lower continuation scale $x_{i,t}$ acts as an increase in marginal cost. This is what will create a link between corporate financial structure and inflation.

A fraction λ of firms is able to set the optimal price given by equation (5), while the remaining fraction $1-\lambda$ of firms leaves prices unchanged. Therefore the aggregate price level follows

$$P_t^{1-\epsilon} = \lambda (P_t^*)^{1-\epsilon} + (1-\lambda)\bar{P}_{t-1}^{1-\epsilon}, \tag{7}$$

where $\bar{P}_{t-1}$ is the price set by firms at date $t-1$.

We follow the standard New Keynesian literature and set $\tau = 1/\epsilon$ to offset the steady-state monopoly distortion. This mostly simplifies expressions and the welfare analysis in Section 3.2. We refer to $\bar{Y}$ as *potential output*; this is the first-best level of output, that would prevail if all firms continued at full scale $x_t = 1$.

Remark 1 (Marginal cost vs. markup). In the baseline model, tighter monetary policy raises prices in financially constrained sectors because it raises *marginal cost*: a lower continuation scale x reduces effective productivity and increases marginal cost, while markups are constant. An alternative and complementary interpretation, emphasized in the literature studying the "missing disinflation" during the Great Recession (Gilchrist, Schoenle, Sim and Zakrajsek, 2017), is that constrained firms may increase *markups* to generate liquidity, potentially at the cost of sacrificing their customer base. Empirically, both mechanisms may coexist, and focusing on marginal cost provides a parsimonious sufficient mechanism.

Natural output. Under flexible prices ($\lambda = 1$), the left-hand side of (5) always equals P_t, as the price level aggregates the optimal price of each firm and firms are symmetric. Moreover all firms choose the same continuation scale $x_{i,t} = x_t$. We denote the equilibrium output under flexible prices, or *natural output*, Y_t^n. It satisfies

$$Y_t^n = x_t^\nu \bar{Y}.$$

When the date-t financial constraint is binding, natural output Y_t^n can fall strictly below $\bar{Y}$.

We now derive the economy's natural output (i.e., aggregate supply) as a function of outstanding leverage. Throughout the paper, we maintain the assumption that parameters are such that firms always seek to maximize their continuation scale $x_{i,t}$ at date t subject to their financial constraints, that is:

Assumption 1. *Profits net of the reinvestment cost, $\Pi^*_{i,t} - \gamma x_{i,t} K$, are increasing in $x_{i,t}$.*

A sufficient condition for Assumption 1 to hold around an unconstrained steady state (i.e., with $x = 1$) is

$$(1-\tau)\nu\bar{Y} > \gamma K. \tag{8}$$

Let $\ell_{i,t-1}$ denote the ex-ante leverage, i.e., the share of the initial investment K that is financed by asset-based long-term debt. Recall that at t, the reinvestment can only be financed by borrowing against the date-$t+1$ cash flow K. It cannot be financed by issuing new equity against the date-t cash flow $\Pi_{i,t}$. The firm must repay $R_{t-1}R_t\ell_{i,t-1}K$ at $t+1$, hence at date t it can continue at full scale $x_{i,t} = 1$ if and only if its remaining pledgeable income $\frac{1}{R_t}\left[K - R_{t-1}R_t\ell_{i,t-1}K\right]$ can cover the maximal reinvestment need γK. Otherwise, the firm is constrained, and its continuation scale satisfies

$$x_{i,t}\gamma K = \frac{1}{R_t}\left[K - R_{t-1}R_t\ell_{i,t-1}K\right].$$

This implies that the optimal continuation scale $x_{i,t}$ (whether the firm can adjust its price or not) can be written as

$$x_{i,t} = \min\left\{1; \frac{1}{\gamma}\left[\frac{1}{R_t} - F_{i,t-1}\right]\right\}, \tag{9}$$

which decreases with the new interest rate R_t and with outstanding debt per unit of capital $F_{i,t-1} = R_{t-1}\ell_{i,t-1}$.[8] The following result characterizes natural output Y^n_t and the Phillips curve that relates equilibrium output Y_t to the aggregate price level P_t under nominal rigidities:

Proposition 1 (Indebted supply, interest rates, and the Phillips curve)**.** *Fix outstanding debt $F_{t-1} = R_{t-1}\ell_{t-1}$ and the interest rate R_t.*

1. ***Natural output:** Natural output is*

$$Y^n_t = x^\nu_t \bar{Y}$$

where the equilibrium continuation scale at t is

$$x_t = \min\left\{1,\ \frac{1}{\gamma}\left(\frac{1}{R_t} - F_{t-1}\right)\right\}.$$

[8]Throughout, we focus on parameter regions such that $1/R_t > F_{i,t-1}$, so firms continue operating rather than shutting down.

Define the threshold

$$\bar{R}(F_{t-1}) = \frac{1}{\gamma + F_{t-1}}. \tag{10}$$

- *If* $R_t \leq \bar{R}(F_{t-1})$*, the financial constraint does not bind,* $x_t = 1$*, and* $Y_t^n = \bar{Y}$*.*
- *If* $R_t > \bar{R}(F_{t-1})$*, the constraint binds,* x_t *is below 1 and strictly decreasing in* R_t*, and* $Y_t^n < \bar{Y}$*.*

Moreover, $\bar{R}(F_{t-1})$ *is strictly decreasing in* F_{t-1}*: higher inherited debt makes aggregate supply more vulnerable to tightening.*

2. ***Inflation:*** *The aggregate price level* P_t *follows*

$$\frac{P_t}{\bar{P}_{t-1}} = \left(\frac{1 - \lambda x_t^{\nu\phi(\epsilon-1)} \left(\frac{\bar{Y}}{Y_t}\right)^{\phi(\epsilon-1)}}{1-\lambda} \right)^{\frac{1}{\epsilon-1}}. \tag{11}$$

Therefore, the inflation-output tradeoff faced by the central bank is kinked at the threshold $\bar{R}(F_{t-1})$*, and the location of this kink shifts with the inherited debt* F_{t-1}*.*

A higher outstanding debt face value F_{t-1} encumbers more of the firm's pledgeable assets, leaving less collateral to back new borrowing. This lowers the interest rate threshold $\bar{R}(F_{t-1})$ at which financial constraints begin to bind at t, making the supply side more vulnerable to monetary tightening.

The direct interpretation is that a higher interest rate R_t tightens firms' financial constraints by lowering the collateral value K/R_t or by increasing the debt burden that needs to be covered by K at $t+1$, consistent with standard models of the financial effects of monetary policy (Farhi and Tirole, 2012) and empirical evidence (Cloyne, Ferreira, Froemel and Surico, 2023).

State- and shock-dependence of the Phillips curve. Part 2 of Proposition 1 draws implications for the relation between inflation and output. Equation (11) can be interpreted as a Phillips curve that maps measures of economic activity to inflation. In the absence of binding financial frictions, we have $x_t = 1$ in (11), corresponding to the usual Phillips curve that gives inflation as an increasing function of the output gap $\bar{Y}/Y_t$, i.e., the ratio between potential output and actual output. With binding financial frictions that lead to $x_t < 1$, the measure of economic activity relevant for inflation depends on both the standard output gap $\bar{Y}/Y_t$ due to excess demand, and on a "supply gap" captured by the term $x_t^{\nu\phi(\epsilon-1)}$. A lower continuation scale x_t increases firms' marginal costs and thus the prices charged by resetting firms.

The shape of the Phillips curve is not only *state-dependent* through the state variable F that affects the locus of the kink, but also *shock-dependent* in the sense that shifts in demand caused by interest rates do not have the same effect as shifts in demand caused by, e.g., fiscal stimulus. Interest rates play a special role because they tighten indebted firms' supply constraints.

A large literature (with recent examples motivated by the post-pandemic inflation surge, e.g., Benigno and Eggertsson 2024, Fornaro 2024) studies kinked or "slanted" Phillips curves wherein the price level or inflation is a highly non-linear function of output Y. In these models, the kink arises from broad supply constraints or the nature of nominal rigidities, and the relationship does not depend on the particular source of variation in aggregate demand. For instance, in the presence of downward nominal wage rigidities (as in, e.g., Schmitt-Grohé and Uribe, 2016; Guerrieri et al., 2021), there is little disinflation or deflation in a recession yet inflation can increase sharply in a boom, but this asymmetry is independent of past monetary policy and of the type of demand shock.

Graphical representation. Figure 2 illustrates how inflation depends on the interest rate R_0 by plotting aggregate demand, denoted Y_0^d, and aggregate supply (i.e., natural output), denoted Y_0^s and equal to $x_0^\nu \bar{Y}$. Raising R_0 contracts demand but can also reduce x_0 and hence natural output when outstanding debt is high. Equilibrium output Y_0 is demand-determined, given by Y_0^d, while inflation increases with the gap between Y_0^d and Y_0^s according to (11). If $Y_0^d > Y_0^s$ there is inflation while if $Y_0^d < Y_0^s$ there is deflation; inflation is zero if and only if the rate R_0 is such that $Y_0^d(R_0) = Y_0^s(R_0)$.

The dotted lines correspond to the frictionless New Keynesian model (or equivalently $\nu = 0$). Figure 3 shows the resulting Phillips curve mapping output Y_0 to inflation P_0, when movements in Y_0 are due to interest rates R_0, again contrasting the solid lined implied by our model with the dotted line in the frictionless New Keynesian model. Note that the kink in the Phillips curve, which depends crucially on the outstanding debt F_{-1}, arises because for low output $Y_0 < \bar{Y}$ (i.e., at high policy rates R_0) the Phillips curve is *flatter* than without financial frictions, and not because the Phillips curve becomes steeper at high output.

Finally, in our baseline model the kink is not just a remote possibility activated only by large disruptions. On the contrary, firms' optimal capital structure choices (described

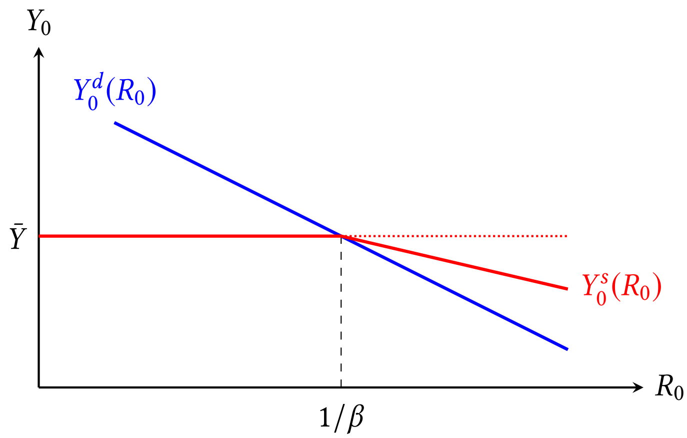

Figure 2: Aggregate demand Y_0^d and aggregate supply Y_0^s as functions of R_0 given steady state leverage. The dotted lines correspond to the frictionless New Keynesian model ($\nu = 0$).

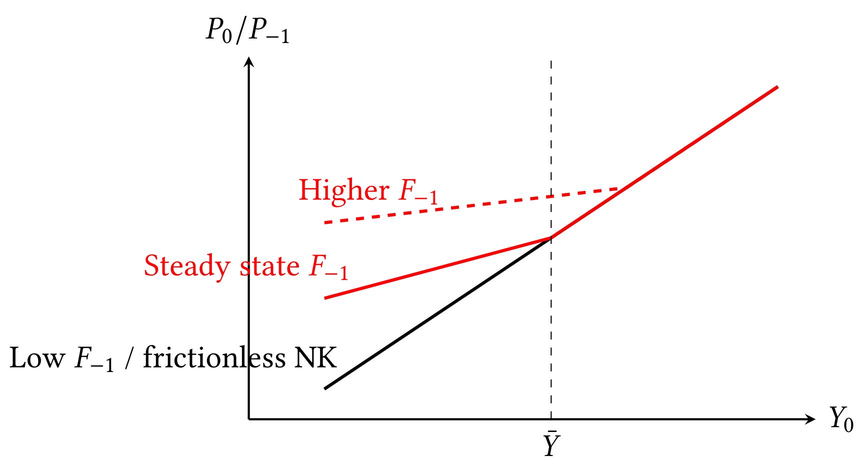

Figure 3: Kinked Phillips curve: $P_0(Y_0)$ when Y_0 is shifted by movements in R_0. For $R_0 > \bar{R}(F_{-1})$, binding financial constraints make the Phillips curve flatter than in the frictionless model. The position of the kink depends on outstanding debt F_{-1}.

in Section 4) place the economy exactly at the kink in steady state. Intuitively, absent shocks, firms take advantage of cheap debt funding as much as possible. This means the constraint is always marginally relevant around the steady state, even for small shocks. The fact that the steady state is exactly at the kink is of course a simplification due to the perfect-foresight environment, but the more general insight is that financial dominance is a first-order consideration in normal times, not merely a tail risk during crises.

Monetary policy response to demand shocks. We now analyze the feasible equilibrium allocations as a function of shocks and policies. We start from an arbitrary level of the model's single state variable F_{-1}, which does not necessarily correspond to the steady state level.

In the main text, we focus on the impact of demand shocks, i.e., transitory shocks to the discount factor β_0. A fall in β_0 corresponds to a positive demand shock, as output increases if monetary policy keeps the rate R_0 constant. An increase in the discount factor $\beta_0 > \beta$ corresponds to a negative demand shock: as is well-known (Eggertsson and Krugman, 2012; Guerrieri and Lorenzoni, 2017), this can be viewed as a reduced form for a household deleveraging shock in models focusing on household debt. Without the supply-side financial frictions in our model, the standard policy response is to set $R_0 = 1/\beta_0$, and the "divine coincidence" holds as the central bank can accommodate the demand shock perfectly, stabilizing both output (at $\bar{Y}$) and inflation (at zero).[9]

Consider first a positive demand shock, i.e., a fall in β_0. We illustrate the first side of "financial dominance": higher outstanding debt acts as a constraint on the central bank's ability to tame inflationary pressures.

There are three cases, depending on the size of the demand shock. First, if the rate $R^n = 1/\beta_0$ that would be optimal in the frictionless model is still lower than $\bar{R}(F_{-1}) = \frac{1}{\gamma + F_{-1}}$, then supply-side financial constraints are not binding, and firms can continue at full scale $x_0 = 1$, and hence monetary policy can stabilize both output and inflation. For completeness we describe this case which can arise for small levels of debt F_{-1}, but if we start from the steady state debt F_{-1} then this case is never relevant. In steady state, firms always choose

[9] The literature (Eggertsson and Woodford, 2003; Werning, 2011) has studied how large negative demand shocks may call for such a low rate R_0 that the zero lower bound (ZLB) binds, in which case it is impossible to maintain $Y_0 = \bar{Y}$ and a recession and deflation must ensue due to insufficient aggregate demand. We abstract away from the ZLB throughout, and assume that the policy rate is unconstrained. In the frictionless New Keynesian benchmark without our supply-side financial frictions, this means the central bank can always achieve $Y_0 = \bar{Y}$ by setting $R_0 = 1/\beta_0$. This allows us to show more clearly that even without ZLB constraints, financial frictions can make it impossible or undesirable to stabilize output at $\bar{Y}$.

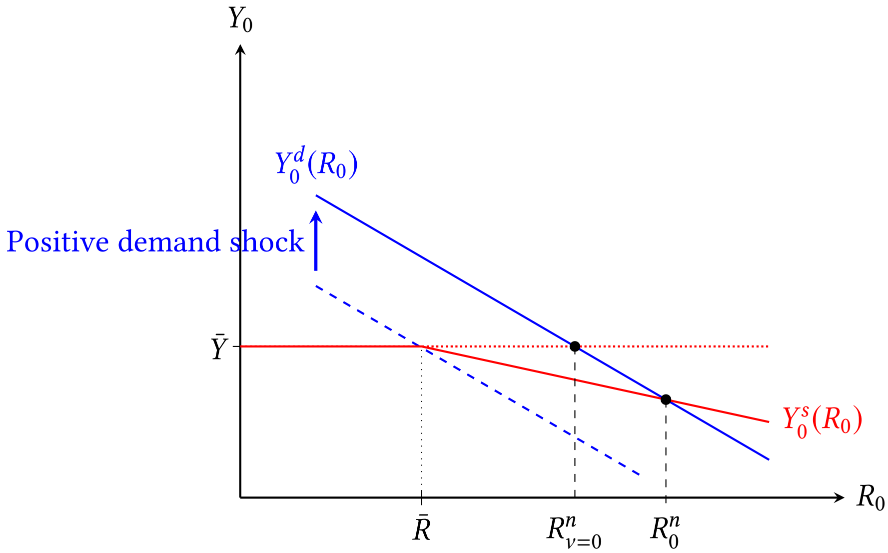

Figure 4: Binding current constraint ($x_0 < 1$) following large positive demand shock $\beta_0 < 1/\bar{R}(F_{-1})$. Here $R^n_{\nu=0}$ is the rate ensuring $Y_0 = \bar{Y}$ while R_0^n is the rate ensuring no inflation.

a sufficiently high leverage such that the steady state real rate $1/\beta$ is exactly $\bar{R}$ and any positive demand shock $\beta_0 < \beta$ will make the supply-side financial constraints bind.

Second, if the positive demand shock is large and $1/\beta_0$ rises above $\bar{R}(F_{-1})$, which is more likely when there is more outstanding corporate debt F_{-1}, then the date-0 interest rate $R_0 = 1/\beta_0$ that stabilizes output at $Y_0 = \bar{Y}$ necessarily leads to date-0 inflation, and the "divine coincidence" fails. Controlling inflation calls for a more restrained policy $R_0^n > 1/\beta_0$ that solves

$$x_0(R_0^n)^\nu = \frac{1}{\beta_0 R_0^n}. \tag{12}$$

The side-effect is that this policy implies a drop in output Y_0 below $\bar{Y}$, as shown in Figure 4. Equation (12) has a solution if $\beta_0 > \underline{\beta}(F_{-1})$ where $\underline{\beta}$ is an increasing function of outstanding debt F_{-1} (whose closed-form expression is given in Proposition 5 below).

The third, worst-case, scenario occurs if the positive demand shock is even larger, $\beta_0 < \underline{\beta}(F_{-1})$, as then it becomes simply impossible to maintain price stability, even if the central bank is willing to accept a drop in output.

Discussion. Cost-push shocks in the monetary economics literature can arise from markup shocks (e.g., modeled in reduced form as stemming from a lower elasticity of substitution ϵ between varieties, cf. Galí 2015), real wage rigidities (Blanchard and Galí, 2007) and asymmetric shocks in multi-sector models (Guerrieri, Lorenzoni, Straub and Werning, 2021;

Rubbo, 2024; Afrouzi, Bhattarai and Wu, 2024). Our model features endogenous cost-push shocks due to financial frictions, closer to the "cost channel" or "working capital channel" of monetary policy (Barth and Ramey, 2001; Ravenna and Walsh, 2006), with three main differences. First, in these models firms always have to pay for a share of wages and inventories in advance hence the cost channel is a permanent feature of the economy, whereas in our framework the precise level of interest rates and corporate leverage matter. Put differently, the interest rate is not always part of firms' marginal costs, and only becomes relevant for firms' pricing and aggregate inflation in the event of heavily indebted supply. Second and relatedly, current interest rates affect firms' capital structure going forward, which, as we showed, can dampen the output effects of monetary easing. Third, our model does not imply that higher rates are inflationary; rather, inherited leverage *raises* the policy rate required to restore price stability after inflationary shocks.

Baqaee, Farhi and Sangani (2024) show that with heterogeneous firms and variable (non-CES) markups, monetary shocks can affect aggregate productivity by reallocating resources across firms with different productivities. Our model offers a complementary supply-side effect of monetary policy: firms are homogeneous and markups are constant under CES demand, so there is no reallocation-based productivity channel. In Appendix A.10, we show how allowing for heterogeneity in firms' productivity A_i and outstanding debt $F_{i,t-1}$ induces a similar reallocation effect of monetary policy even with CES constant markups. We show that, relative to a representative-firm benchmark, aggregate supply is more sensitive to rate shocks by a term proportional to

$$\text{Cov}\left(A_i^{\phi(\epsilon-1)}, F_{i,t-1}\right),$$

hence heterogeneity amplifies the sensitivity if more productive firms are more levered.

3.2 Optimal policy and the welfare costs of corporate leverage

We now show how ex-post optimal monetary policy, taking outstanding debt F_{-1} as given, trades off minimizing the supply-side effects of financial frictions against the usual New Keynesian distortions.

We first isolate the *ex-post* constraint imposed by outstanding corporate leverage. Accordingly, we take existing debt F_{-1} as given and, for now, shut down the dynamic effects studied in Section 4 by assuming $x_1 = 1$ (e.g., because in the relevant range of R_0, new firms choose full continuation at $t = 1$). The central bank sets its policy rate R_0 to maximize date-0 welfare

$$W_0 = \log(C_0) - \chi N_0 \tag{13}$$

subject to the date-0 implementability constraints

$$\begin{cases} C_0 = \frac{\bar{Y}}{\beta_0 R_0} \\ N_0 = \mathcal{N}\left(\frac{Y_0(R_0)}{x_0(R_0, F_{-1})^{\nu}\bar{Y}}\right) \end{cases} \tag{14}$$

where the function $\mathcal{N}$, described in Appendix A.1, maps the output gap $G_t = \frac{Y_t}{x_t^{\nu}\bar{Y}}$ to aggregate labor demand.

In the standard New Keynesian model without financial constraints (so that $x_t = 1$ at all times), the central bank faces two sources of inefficiency, both apparent in the aggregate labor demand (A.1). With sticky prices but no dispersion across firms ($\lambda = 0$), we have $\Delta = 1$, hence $\mathcal{N}(G) = \bar{N}G^{\frac{1}{1-\alpha}}$ which can still depart from the first-best labor supply $\bar{N}$. The output gap term G captures the standard welfare cost of an overheated economy. In addition, when $\lambda > 0$, $\mathcal{N}(G)$ also captures the labor dispersion (and therefore misallocation, since all firms have the same marginal cost) resulting from price stickiness. The "divine coincidence" is the frictionless New Keynesian model states that (given the correct steady-state labor subsidy $\tau = 1/\epsilon$) both inefficiencies are shut down when $G = 1$: when there is no output gap, the Phillips curve (11) implies zero inflation and therefore no price dispersion.

Natural rate vs. optimal rate. Define the *date-0 natural rate* $R_0^n(F_{-1})$ as the policy rate that implies $G_0 = 1$ and therefore closes the output gap, which also ensures price stability and no price dispersion at $t = 0$. This requires

$$x_0(R_0, F_{-1}) = (\beta_0 R_0)^{-1/\nu}. \tag{15}$$

If $R_0 \leq \bar{R}(F_{-1}) \equiv (\gamma + F_{-1})^{-1}$, then $x_0 = 1$ and (15) yields $R_0^n = 1/\beta_0$ as in the frictionless benchmark. If instead $R_0 > \bar{R}(F_{-1})$, then $x_0 = (1/\gamma)(1/R_0 - F_{-1})$ and (15) becomes

$$(\beta_0 R_0)^{-1/\nu} = \frac{1}{\gamma}\left(\frac{1}{R_0} - F_{-1}\right), \tag{16}$$

which may have no feasible solution if the right-hand side is too small (i.e., if F_{-1} is too large). In such cases, no policy can implement $G_0 = 1$. This shows that the natural rate R_0^n is either independent of F_{-1} at low F_{-1}, or *increasing* in F_{-1} at high values of F_{-1}: intuitively, when outstanding corporate leverage is higher, a higher policy rate is required for price stability.

The *optimal rate*, denoted $R_0^{opt}(F_{-1})$, however, behaves very differently. The central bank sets R_0^{opt} to maximize date-0 welfare (13) subject to (14). It is useful to define the distortion index

$$M(G) \;=\; \chi \mathcal{N}'(G)\, G. \tag{17}$$

Then, any interior optimum satisfies one of these two conditions:

1. **Unconstrained region** $R_0 \le \bar{R}(F_{-1})$: since $x_0 = 1$, we have $G_0 = 1/(\beta_0 R_0)$ and the Ramsey optimality condition is
$$M(G_0) = 1. \tag{18}$$

2. **Constrained region** $R_0 > \bar{R}(F_{-1})$: using $x_0 = (1/\gamma)(1/R_0 - F_{-1})$, one can write $\frac{d \log G_0}{d \log R_0} = -1 + \nu/(1 - F_{-1}R_0)$. The Ramsey optimality condition becomes
$$M(G_0)\left(1 - \frac{\nu}{1 - R_0 F_{-1}}\right) = 1. \tag{19}$$

In the frictionless limit $\gamma \to 0$ (or $F_{-1} \to 0$), the constrained region disappears and the FOC reduces to the standard gap-closure condition $G_0 = 1$.

In the constrained region, (19) shows that the optimal policy balances the standard New Keynesian stabilization objective (setting $M(G_0) = 1$) against productivity losses from financial frictions, captured by the term $\nu/(1 - R_0 F_{-1})$. When the supply-side financial distortion is sufficiently strong (i.e., ν or outstanding debt F_{-1} sufficiently high), the optimal policy is to avoid any ex-post decline in aggregate supply. Let

$$G_k = G_0(\bar{R}(F_{-1}), F_{-1}) = 1/(\beta_0 \bar{R}(F_{-1})).$$

The kink is optimal, that is, $R_0^{opt} = \bar{R}$, if the left-derivative of W_0 at $\bar{R}$ is weakly positive and the right-derivative is weakly negative, i.e.

$$M(G_k) \;\ge\; 1 \qquad \text{and} \qquad M(G_k)\left(1 - \frac{\nu}{1 - F_{-1}\bar{R}(F_{-1})}\right) \;\le\; 1. \tag{20}$$

When $1 - \nu/(1 - F_{-1}\bar{R}(F_{-1})) > 0$, (20) is equivalent to $1 \le M(G_k) \le 1/\big(1 - \nu/(1 - F_{-1}\bar{R}(F_{-1}))\big)$.

Proposition 2 (Ex-post optimal policy with indebted supply)**.** *Fix F_{-1} and a date-0 demand shifter β_0, and assume $x_1 \equiv 1$.*

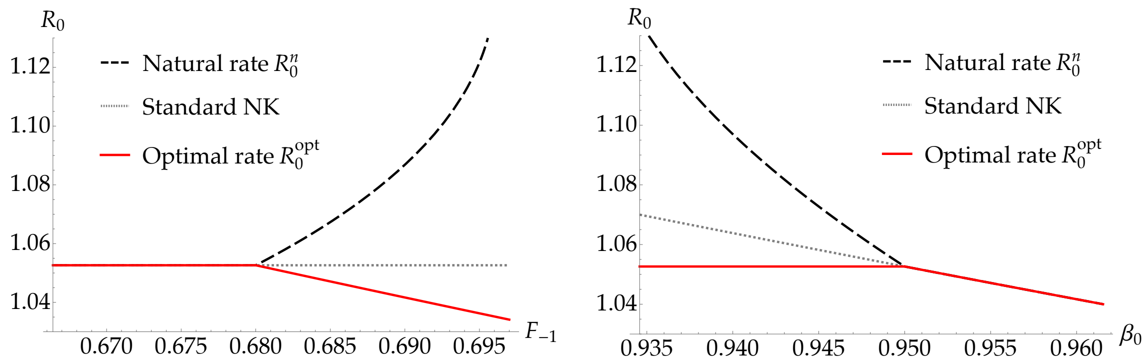

Figure 5: Natural rate R_0^n (black dashed) and in standard New Keynesian model (gray dotted) vs. optimal rate R_0^{opt} (solid red) as a function of outstanding debt F_{-1} on the left panel, and as a function of the date-0 demand shock β_0 on the right panel.

(i) If $1/\beta_0 \leq \bar{R}(F_{-1})$ or equivalently $F_{-1} + \gamma \leq \beta_0$ (debt sufficiently low relative to the demand shock), then:

- *the natural rate is $R_0^n(F_{-1}) = 1/\beta_0$;*
- *the Ramsey-optimal policy sets $R_0^{opt}(F_{-1}) = R_0^n(F_{-1}) = 1/\beta_0$ as in the frictionless New Keynesian model.*

(ii) If $1/\beta_0 > \bar{R}(F_{-1})$ or equivalently $F_{-1} + \gamma > \beta_0$ (debt sufficiently high relative to the demand shock), then:

- *the natural rate $R_0^n(F_{-1})$ solves (16)* ***increases*** *with outstanding debt F_{-1};*
- *the Ramsey optimum is either at the kink $R_0^{opt} = \bar{R}(F_{-1})$ or in the constrained region $R_0^{opt} > \bar{R}(F_{-1})$ solving (19). Under condition (20), the kink is optimal: $R_0^{opt}(F_{-1}) = \bar{R}(F_{-1})$ and hence the optimal policy rate* ***decreases*** *with outstanding debt F_{-1}.*

Proposition 2 highlights a sharp form of financial dominance: as leverage rises, the inflation-targeting rate R_0^n increases while the welfare-optimal rate R_0^{opt} can decrease. When F_{-1} is high, the natural rate R_0^n rises because a higher rate is needed to offset the effective cost-push component created by a lower continuation scale x_0. In contrast, from a normative perspective, raising the rate in a highly levered state is particularly costly because it has an acute effect on tightening firms' collateral constraints, which induces a large productivity loss. If this supply-side cost of tightening is large enough, it dominates the welfare costs

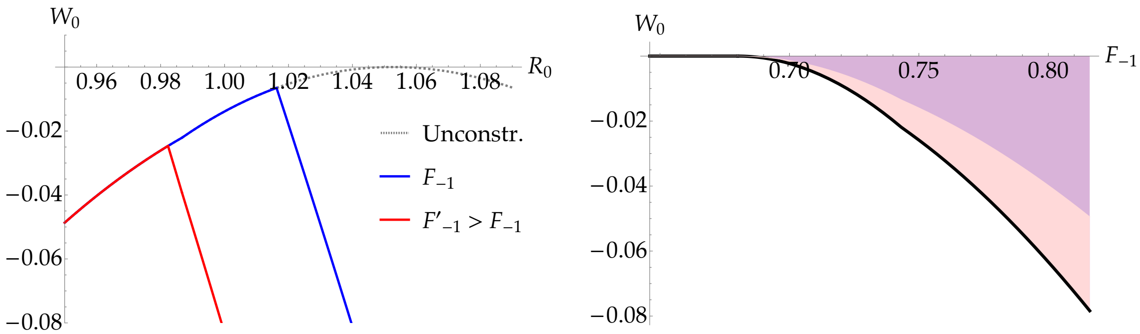

Figure 6: Static welfare W_0 (relative to first best). Left panel: As a function of R_0 in the unconstrained case (dotted line, frictionless model with $x_0 = 1$) and two levels of outstanding debt F_{-1} and $F'_{-1} > F_{-1}$. Right panel: As a function of F_{-1} under the optimal policy R_0^{opt}. The darker (resp. lighter) region indicates welfare losses due to overheating (resp. price dispersion).

of overheating and inflation, and the planner chooses not to tighten beyond the kink and instead tolerates the resulting inflation to avoid triggering a sharp decline in supply.[10]

Figure 5 illustrates Proposition 2. The left panel shows how the optimal rate (solid red) diverges from the natural rate (dashed black) as outstanding debt F increases: once F exceeds the threshold where the constraint binds, the optimal policy stops at the kink $\bar{R}(F)$ rather than tracking the natural rate. The right panel shows the analogous pattern as a function of the demand shock β_0: for large positive demand shocks (low β_0), the optimal rate again stops at the kink.

Figure 6 shows the welfare consequences. The left panel plots date-0 welfare as a function of R_0 for different debt levels: higher debt shifts the welfare-maximizing rate leftward toward the kink. The right panel decomposes welfare losses *under the optimal policy* R_0^{opt} into overheating (dark) and price dispersion (light) components, showing that both increase with outstanding leverage.

4 Market Timing

Section 3 treated the stock of outstanding debt as predetermined and asked how it constrains monetary policy *ex post*. We now close the model by endogenizing firms' leverage choices. The key new force is market timing: when the policy rate moves, it can change the

[10] The optimal rate R_0^{opt} can be decreasing in F_{-1} even when the kink is not optimal, i.e., if R_0^{opt} is interior, strictly between $\bar{R}$ and R_0^n. We focus on the simple case $R_0^{opt} = \bar{R}$ which yields transparent comparative statics.

relative cost of debt and equity, inducing firms to re-optimize their capital structures. Since leverage chosen at $t = 0$ affects the continuation scale x_1 at $t = 1$, monetary policy involves an intertemporal problem even where the current supply constraint does not bind. We then draw implications for optimal policy, highlighting a prudential motive for "leaning against the wind" even when the static divine coincidence holds.

4.1 Optimal capital structure: market timing vs. future financial distress

The firm must fund its initial investment K by selling securities. Let $\ell_{i,t} \in [0, 1]$ be the leverage ratio chosen by firm i at date-t, so that the firm raises $\ell_{i,t}K$ in debt and $(1 - \ell_{i,t})K$ in equity. The cost of debt is R_t and the cost of equity is $R_t^E \geq R_t$.

The optimal leverage ratio solves

$$\max_{\ell_{i,t} \in [0,1]} \Pi_{i,t+1}\left(x_{i,t+1}(\ell_{i,t})\right) - R_t^E(1 - \ell_{i,t})K + \frac{K - R_{t+1}\left[\gamma x_{i,t+1}(\ell_{i,t})K + R_t \ell_{i,t} K\right]}{R_{t+1}}, \tag{21}$$

where the continuation scale $x_{i,t+1}$ is a weakly decreasing function of outstanding leverage $\ell_{i,t}$ given by (9), and we write real profits given optimal pricing as an increasing function of the continuation scale $\Pi^*_{i,t+1}(x_{i,t+1})$, omitting the dependence in aggregate variables to ease notation.

To understand better the firm's problem, we can rewrite the firm's objective function, up to constant terms not affecting the optimization problem, as:

$$\underbrace{\left[\Pi_{i,t+1}(x_{i,t+1}(F_{i,t})) - \gamma x_{i,t+1}(F_{i,t})K\right]}_{\text{net profits from production}} \quad + \quad \underbrace{\left[\frac{R_t^E}{R_t} - 1\right] F_{i,t}K}_{\text{profits from cheaper debt financing}} \tag{22}$$

where $F_{i,t} = R_t \ell_{i,t}$ is the date-$t+1$ face value, and we use the fact that $x_{i,t+1}$ only depends on $\ell_{i,t}$ through the face value $F_{i,t}$. Equation (22) highlights that firms balance two objectives. The first term represents the firm's operating profits net of reinvestment costs, which are maximized at full continuation $x_{i,t+1} = 1$. The second term captures the financial gains from substituting cheap debt for expensive equity. When $R_t^E > R_t$, firms face a tradeoff: increasing leverage raises the financing gain but reduces operating value by lowering the continuation scale.

Importantly, the relevant variable for firms' ex-ante capital structure is the *wedge* between R_t^E and R_t (and more generally the wedge between the cost of equity and the cost of debt, if the latter departs from R_t), and not the interest rate R_t per se. Thus our model does not predict that low interest rates necessarily lead firms to borrow more because the cost of debt is lower; if the cost of equity falls by the same amount then firms' capital structure is unaffected.

Our model captures in a simple form insights from the "market timing" theory of capital structure. Baker and Wurgler (2002) show that firms repurchase their shares when equity valuations are low and issue more when equity valuations are high. Ma (2019) extends this logic to pricing fluctuations in both stock and bond prices, showing that firms act as cross-market arbitrageurs in their own securities. In our model, these findings can be interpreted as fluctuations in the wedge R_t^E/R_t: a higher value (that makes debt more attractive) could correspond to either low equity valuations or high debt valuations. Recent work by Mota (2023) and Di Tella, Hébert, Kurlat and Wang (2023) argues that just like Treasury bonds, corporate bonds bear a "convenience yield" which could again be interpreted as one component of the debt-equity spread, i.e., an increase in R_t^E/R_t corresponds to a higher convenience yield on debt leading firms to issue more debt.

Remark 2 (Corporate liquidity hoarding). In our framework, it is without loss of generality to assume that the firm invests the entirety of the equity raised at t in its long-term investment K, and in particular does not hoard liquidity from t to $t+1$. Indeed, suppose that the firm raises $L_{i,t}K$ in debt and $(1-L_{i,t})K + w_{i,t}K$ in equity, and invests the additional amount $w_{i,t}K$ in other firms' liquid debt in order to cover part of its future reinvestment need. The key point is that the firm earns a low return R_t on these liquid savings between t and $t+1$. If the firm issues new debt $d_{i,t+1}K = \gamma x_{i,t+1}K - R_t w_{i,t}K$ and continues at scale $x_{i,t+1}$, its total debt repayment at $t+2$ equals

$$R_t R_{t+1} L_{i,t} K + R_{t+1} d_{i,t+1} K = R_{t+1}\left[\gamma x_{i,t+1} + R_t \ell_{i,t}\right] K$$

where $\ell_{i,t} = L_{i,t} - w_{i,t}$ is the net leverage per unit of K. As a result, the problem is equivalent to simply choosing $\ell_{i,t}$ as in (21). Intuitively, as in Holmström and Tirole (1998), liquidity hoarding is costly and there is no advantage in issuing more equity ex ante to save more. If the liquidity premium is too high, firms will voluntarily under-insure against the date-$t+1$ liquidity need, implying $x_{t+1} < 1$.[11] In practice, there may be considerations outside of our

[11] Rampini and Viswanathan (2010) model optimal hedging under ex-ante financial constraints, and Eisfeldt and Muir (2016) show that firms are more likely to raise external finance and accumulate liquidity when R_t^E/R_t is low.

model–such as uncertain cash flows, investment needs and financing costs—that generate market-timing incentives to hoard cash buffers for future investments (see, e.g., Acharya, Byoun and Xu 2024). We discuss next the role of such uncertainty and induced liquidity risk.

Remark 3 (Liquidity risk). Our framework can be extended to allow for risk, including in the cash flows and the reinvestment need. The literature on corporate risk management (Froot, Scharfstein and Stein 1993, Holmström and Tirole 1998) emphasizes that the interaction of future shocks and financial constraints creates an ex-ante demand for insurance even though firms are risk-neutral. In our context, suppose that each firm's liquidity shock γ_{it+1} is drawn from a distribution $\Gamma(\cdot)$ so that the firm's ex-ante objective is

$$\int \left\{\Pi^*_{i,t+1}\left(x_{i,t+1}(F_{i,t},\gamma_{it+1})\right) - \gamma_{i,t+1}x_{i,t+1}(F_{i,t},\gamma_{it+1})K\right\} d\Gamma(\gamma_{i,t+1}) + \left[\frac{R^E_t}{R_t} - 1\right] F_{i,t}K,$$

where $x_{i,t+1} = \min\left\{1; \frac{1}{\gamma_{i,t+1}}\left[\frac{1}{R_{t+1}} - F_{i,t}\right]\right\}$ depends on both the face value $F_{i,t}$ and the realized shock $\gamma_{i,t+1}$. Relative to our baseline model without uncertainty, this expression still highlights the trade-off between continuation scale and the lower cost of debt. The only difference is that firms have an additional precautionary savings motive to preserve debt capacity which leads them to choose a lower $F_{i,t}$ than without uncertainty, and that in general we cannot obtain a closed-form for the optimal solution $F_{i,t}$. However, even without explicit solution, the qualitative properties of the solution are exactly the same as in Proposition 3. The objective function is supermodular in $F_{i,t}$ and R^E_t/R_t, in the sense that the cross partial derivative with respect to these two variables is positive. Therefore, the solution $F_{i,t}$ is a weakly increasing function of the spread R^E_t/R_t (Milgrom and Shannon, 1994). Firms choose $x_{i,t+1} = 1$ in all states if R^E_t/R_t is low enough, and if R^E_t/R_t is high enough they choose to under-insure and allow $x_{i,t+1} < 1$ in some states (high $\gamma_{i,t+1}$). The same point applies in the presence of risk affecting the profits $\Pi_{i,t+1}$, for instance aggregate risk affecting Y_{t+1} or idiosyncratic risk to firms' demand or productivity.

In what follows, the only object that matters for firms' market-timing incentives is the *relative* required return on equity versus debt. It is therefore convenient to work with the wedge

$$g_t = R^E_t/R_t,$$

which can in principle vary with the policy rate because of taxes, agency costs, risk premia, illiquidity/convenience yields, or segmented investor demand. We focus on a perfect foresight path starting at date t. Suppose that

$$\gamma \leq \frac{1}{R_{t+1}} < \gamma + R_t. \tag{23}$$

The first inequality implies that when the firm is fully equity-funded ($\ell_{i,t} = 0$), it always has enough debt capacity at $t+1$ to continue at full scale $x_{i,t+1} = 1$; the second inequality implies that at the maximal leverage $\ell_{i,t} = 1$, the firm is constrained and must downscale to $x_{i,t+1} < 1$. Then there exists a maximal leverage

$$\bar{\ell}_t = \frac{1}{R_t}\left[\frac{1}{R_{t+1}} - \gamma\right] > 0 \tag{24}$$

below which full continuation at $t+1$ is possible, i.e., $x_{i,t+1} = 1$ for $\ell_{i,t} \leq \bar{\ell}_t$. The maximal leverage that allows full continuation is decreasing in R_t because a lower R_t implies a lower repayment and thus more debt capacity going forward, and in R_{t+1} as a lower new interest rate boosts the collateral value of the date-$t+2$ pledgeable income K.

The following result derives the firm's optimal ex-ante capital structure, and shows that firms are willing to accept a continuation scale $x_{i,t+1} < 1$ in the next period if at the investment date t, the cost of debt is sufficiently low relative to the cost of equity:

Proposition 3 (Optimal capital structure)**.** *The date-t optimal ex-ante choice of leverage ℓ_t implies a date-$t+1$ continuation scale*

$$x^*_{t+1} = \min\left\{1, \frac{\bar{x}}{\left(R^E_t/R_t\right)^{\frac{1}{1-\nu}}}\right\}$$

where $\bar{x} = \left[\frac{(1-\tau)\nu\bar{Y}}{\gamma K}\right]^{\frac{1}{1-\nu}} > 1.$

Suppose that the debt-equity wedge satisfies

$$R^E_t/R_t = g(R_t),$$

where g is a weakly decreasing function of R_t such that $\lim_{R\to 0} g(R) > \bar{x}^{1-\nu} > \lim_{R\to\infty} g(R)$. *Then there exists a market-timing rate threshold*

$$R^{MT} = g^{-1}\left(\bar{x}^{1-\nu}\right). \tag{25}$$

such that:

- *if $R_t \geq R^{MT}$, then firms choose the maximal leverage consistent with full continuation, $\ell_t = \bar{\ell}_t$ defined in (24), and thus $x^*_{t+1} = 1$;*
- *if $R_t < R^{MT}$, then firms choose $x^*_{t+1} < 1$ with*

$$x^*_{t+1} = \bar{x}\, g(R_t)^{-\frac{1}{1-\nu}},$$

and the associated leverage satisfies $\ell_t = \frac{1}{R_t}\left(\frac{1}{R_{t+1}} - \gamma x^*_{t+1}\right) > \bar{\ell}_t$.

In this region, a lower policy rate R_t increases leverage, and lowers future continuation x^*_{t+1}.

Proposition 3 reveals a simple but important point: leverage responds to the *relative* (risk-adjusted) cost of debt and equity, not mechanically to the level of the policy rate. If monetary easing reduced the cost of debt and the cost of equity in parallel, the capital-structure tradeoff would be unchanged and optimal leverage would not move. What drives a leverage boom in the model is an increase in the wedge R^E_t/R_t, i.e., a stronger pass-through of monetary policy to the cost of debt than to the cost of equity (or any other force that lowers the risk-adjusted cost of debt relative to equity).

Our results relate to López-Salido, Stein and Zakrajsek (2017), who show that elevated credit-market sentiment, which could be viewed as an increase in the debt-equity wedge, predicts a decline in future economic activity. Building on these empirical findings, Greenwood, Hanson and Jin (2023) and Krishnamurthy and Li (2024) incorporate credit-market sentiment in a macro-finance model and study boom-bust cycles, focusing on the dynamics of beliefs about credit risk. As pointed out earlier, the wedge R^E_t/R_t can reflect the type of credit-market sentiment (or equity-market sentiment) driving these findings. Our simpler structure can be embedded in a New Keynesian model to discuss the role to monetary policy in affecting both ex-ante corporate capital structures and the ex-post costs of leverage.

Remark 4 (Risk premium). Since Bernanke and Kuttner (2005), the empirical literature has emphasized the positive effect of monetary tightening on the equity risk premium. In a richer environment with aggregate risk, what matters for the market-timing mechanism is the *risk-adjusted* wedge between the cost of equity and the cost of debt. Accounting for risk in a way consistent with Bernanke and Kuttner (2005) could thus strengthen our conclusion that monetary easing makes debt more attractive relative to equity.

Example: Constant additive spread. To build intuition, consider the additive spread specification $R^E_t = R_t + \kappa$ with constant $\kappa > 0$. Then $g(R) = 1 + \kappa/R$ is indeed decreasing in

R and the market-timing threshold is explicit:

$$R^{MT} \;=\; \frac{\kappa}{\bar{x}^{\,1-\nu}-1}.$$

In the market-timing region $R_t < R^{MT}$, future continuation satisfies

$$x^*_{t+1} = \bar{x}\left(\frac{1}{1+\kappa/R_t}\right)^{\frac{1}{1-\nu}} < 1,$$

so easing that lowers R_t increases leverage and reduces future natural output.

Foundations for the debt-equity wedge. The wedge between R^E_t and R_t could stem from a combination of compensation for additional costs borne by equity investors on the one hand, and attractive properties that allow debt to pay a lower return on the other hand. We adopt a general and parsimonious specification of the financial frictions for simplicity and to highlight that these are the only ingredients that we need; in the Appendix we offer several non-exclusive microfoundations. First, it could be viewed as a transaction or illiquidity cost for equity. For instance, equity holders face their own liquidity shocks and sometimes need to sell their shares to consume early. In that case, the wedge could capture the expected transaction cost or search cost, which is then priced in the initial cost of equity capital. Second, the wedge could be a compensation for the cost of verifying the firm's date-$t+1$ income, or more generally, monitoring and information acquisition costs (see Appendix A.7 for such a microfoundation), whereas the terminal cash flow K is perfectly verifiable at no cost and not subject to agency costs.

In addition, the wedge could incorporate a convenience yield that lowers the required return on debt relative to equities as in Diamond (2020), Mota (2023) and Di Tella, Hébert, Kurlat and Wang (2023), who point out that the high equity premium puzzle may in part reflect a low safe debt rate puzzle instead. Appendix A.6 solves the full model under a standard debt-in-the-utility specification. Relatedly, the wedge could result from segmented investor demand across asset classes, in the spirit of demand-based asset pricing and inelastic markets in Koijen and Yogo (2019) and Gabaix and Koijen (2021): if monetary policy primarily moves the return on money-market instruments that are closer substitutes for corporate debt than for equity, then the pass-through of policy to required returns is stronger for debt, generating an interest-rate-dependent wedge between R^E_t and R_t. Consistent with this demand-based view of corporate debt pricing, Fang (2025) shows that monetary tightening triggers sizeable outflows from bond funds which propagate policy shocks to corporate bond yields and debt issuance.

Finally, the wedge could simply reflect mispricing that potentially fluctuates over time as in the "market timing" literature that analyzes fluctuations in both "equity-market sentiment" (Baker and Wurgler 2002, Ma 2019) and "credit-market sentiment" (López-Salido, Stein and Zakrajsek 2017, Greenwood, Hanson and Jin 2023, Krishnamurthy and Li 2024).

4.2 Self-defeating monetary easing at low rates

In the baseline New Keynesian model, the policy rate affects current output solely through aggregate demand. In our framework, policy affects output not only through demand, but also through endogenous balance-sheet responses that shift *future* natural output. The key object is the IS curve

$$Y_0 = \frac{x_1(R_0)^{\nu}\bar{Y}}{\beta_0 R_0}, \tag{26}$$

which shows that monetary easing stimulates demand by lowering R_0 but can simultaneously reduce the numerator, by inducing market-timing leverage that lowers x_1.

Consider first the case of monetary easing, that is, a decrease in the policy rate R_0. The standard effect is to stimulate consumption and thus output Y_0 through an intertemporal substitution channel, that is, by lowering the denominator in equation (26). If future aggregate supply is unconstrained ($x_1 = 1$) then this is the only effect of the rate cut, and we recover the standard IS curve. The interest-elasticity of output $-\frac{d\log Y_0}{d\log R_0}$ in this case is equal to 1, which is the elasticity of intertemporal substitution given our logarithmic preferences.

Suppose now that $x_1 < 1$ and future supply is constrained. In that case, the date-0 rate cut also has a counterveiling *negative* effect on output Y_0 as a lower rate R_0 decreases the numerator in (26). In what follows, we assume that the condition on R_t^E/R_t in Proposition 3 holds. The monetary shock affects the capital structure of new firms ℓ_0, and therefore next period's continuation x_1, which is increasing in R_0 at sufficient low rates $R_0 < R^{MT}$. Following this pure monetary policy shock (i.e., there is no simultaneous shock to fundamentals, which is the configuration we study in the next section), firms view the lower rate R_0 as an opportunity to time the market and the rate cut spurs a corporate leverage boom because the cost of debt falls by more than the cost of equity. The shift towards debt, in turn, makes the future supply "indebted" and causes a contraction in future output Y_1, that cannot be undone by future monetary policy because prices are not sticky anymore at $t = 1$.

As a result, in the constrained region $R_0 < R^{MT}$, aggregate output Y_0 is less responsive to monetary policy because the impact of R_0 on young firms' leverage and thus the date-1 production capacity mitigates the impact on current demand. The response of corporate balance sheets undermines the stimulative effect of the rate cut Y_0:[12]

Proposition 4. *The interest-elasticity of output around an arbitrary rate R_0 is*

$$-\frac{d\log Y_0}{d\log R_0} = \begin{cases} 1-\frac{\nu}{1-\nu}\eta_g & \text{if } R_0 < R^{MT} \\ 1 & \text{if } R_0 > R^{MT} \end{cases} \tag{27}$$

where $R^{MT} = g^{-1}(\bar{x}^{1-\nu})$ and $\eta_g = -R_0 g'(R_0)/g(R_0)$ is the interest-rate elasticity of the debt-equity wedge.

The effect of monetary policy on output Y_0 depends on what happens to the *future* productive capacity x_1, whereas the response of inflation P_0/P_{-1} depends on what happens to the *current* productive capacity $x_0 = \min\left\{1; \frac{1}{\gamma}\left[\frac{1}{R_0} - F_{-1}\right]\right\}$. Given outstanding debt F_{-1}, firms' productive capacity is constrained at $t = 0$ if the interest rate R_0 is sufficiently high:

$$x_0 < 1 \Leftrightarrow R_0 > \bar{R}(F_{-1}) = \frac{1}{\gamma + F_{-1}}.$$

The current continuation scale x_0 does not affect output Y_0, which is fully determined by the IS curve (26), as in the standard New Keynesian model. However, x_0 is crucial in determining date-0 inflation through the Phillips curve (11). The analytical expression for $d\log P_0/d\log R_0$ is less tractable than (27) so we will directly analyze instead what interest rate is required to maintain price stability. Intuitively, a rate hike that leads to lower x_0 is equivalent to a cost-push shock, which leads to more inflation even holding output Y_0 fixed. The effect of cost-push shocks in the standard New Keynesian model is well-understood; what is key here is that the magnitude of the "effective cost-push shock" depends on both current monetary policy R_0 and outstanding corporate debt F_{-1}.[13]

Consider next a negative demand shock, i.e., a rise in β_0. If the shock is small so that the stabilization rate $R_0 = 1/\beta_0$ remains *above* the market-timing threshold R^{MT} (equivalently, $\beta_0 \le 1/R^{MT}$), then setting $R_0 = 1/\beta_0$ does not change firms' capital structure choices. Thus

[12] In Appendix A.8 we extend Proposition 4, which is written with log-utility, to the case of a general elasticity of intertemporal substitution (EIS) σ.

[13] The benchmark New Keynesian model which can be viewed as the limit $\nu \to 0$. With extremely strong financial frictions (i.e., high ν), the supply contraction from higher rates (through binding financial constraints) could in principle dominate the demand contraction, leading to "stagflationary" effects of tightening. While such a regime is theoretically possible and potentially relevant for understanding certain historical episodes, we focus our discussion on the empirically more plausible case where demand effects dominate.

in the next period, we still have full capacity $x_1 = 1$ and $Y_1 = \bar{Y}$, and the economy reverts to the steady state at $t = 1$. Thus if $\beta_0 \leq 1/R^{MT}$ it remains optimal to set $R_0 = 1/\beta_0$ regardless of the policy weights on inflation and output, and the "divine coincidence" still holds. The central bank can achieve "full employment" $Y_0 = \bar{Y}$ while avoiding inflation at both $t = 0$ and $t = 1$.

If instead the shock is large enough that $1/\beta_0 < R^{MT}$ (i.e., $\beta_0 > 1/R^{MT}$), then stabilization requires operating in the market-timing region, and the intertemporal tradeoff emerges. Suppose, for instance, that monetary policy sets $R_0 = 1/\beta_0$, which would be optimal without financial frictions. In our model, firms respond to monetary easing by tilting their capital structure towards more debt, sacrificing future capacity x_1 to take advantage of the cheap rate R_0 relative to the cost of cash flow-based claims R_0^E. The future negative supply shock (due to the rate-driven leverage boom at $t = 0$ inducing "indebted future supply") acts a present negative demand shock: future financial distress $x_1 < 1$ hurts households' future income in general equilibrium, and thus they respond by consuming less at $t = 0$ already. This "self-defeating easing" mechanism is conceptually distinct from the bank-based "reversal rate" channel (e.g., Abadi, Brunnermeier and Koby 2023, Wang 2025) in which low or negative rates weaken bank profitability due to the behavior of deposit rates and thereby tighten credit supply. Here the nonlinearity operates through corporate balance-sheet choices and the resulting endogenous tightening of future supply constraints.

Moreover, the fact that x_1 falls below 1 in this case implies that setting $R_0 = 1/\beta_0$ (i.e., the rate that would perfectly offset the negative demand shock absent financial frictions) is not even sufficient to achieve $Y_0 = \bar{Y}$, as this would imply

$$Y_0 = x_1 (1/\beta_0)^{\nu} \bar{Y} < \bar{Y}.$$

To prevent the date-0 recession, the central bank thus needs to ease *even more* at $t = 0$ than in the absence of financial constraints, i.e., attaining full employment $Y_0 = \bar{Y}$ requires setting a rate R_0 even lower than $1/\beta_0$. But this comes at the expense of an even larger increase in leverage ℓ_0 and thus and even tighter future financial constraints and lower x_1.

This forward-looking logic is the other side of "financial dominance": financial decisions by firms (and financial intermediaries) in response to interest rates end up weakening the power of monetary policy and may lead to a form of "over-accommodation". Our model isolates carefully demand and supply factors, and in particular how the interaction between monetary policy and financial constraints generates supply shocks that worsen the tradeoff between inflation and economic activity. More precisely, achieving $Y_0 = \bar{Y}$ requires a rate

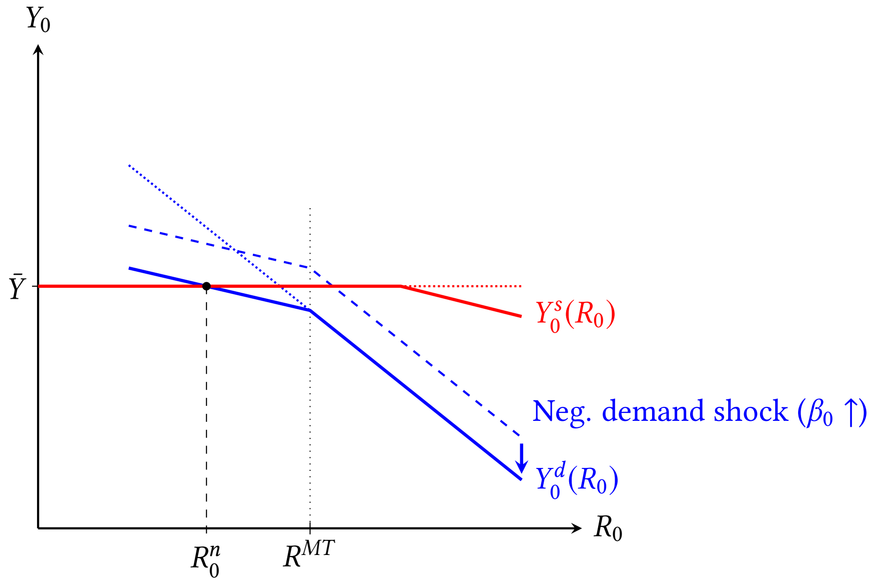

Figure 7: Binding future constraint ($x_1 < 1$) following large negative demand shock $\beta_0 > 1/R^{MT}$. The rate R_0^n allows to stabilize date-0 output and inflation, at the cost of a fall in x_1.

R_0 that solves

$$x_1(R_0)^\nu = \beta_0 R_0, \tag{28}$$

as depicted in Figure 7. But perfect macroeconomic stabilization at $t = 0$ can only be achieved by sacrificing future supply, i.e., allowing $x_1 < 1$.

Our model, therefore, generates an endogenous "slow recovery" in response to large negative demand shocks, consistent with the historical evidence in Cerra and Saxena (2008), Reinhart and Rogoff (2009), and especially Ivashina, Kalemli-Ozcan, Laeven and Mueller (2024) who emphasize the role of corporate debt booms. In our case, the key driver is the effect of monetary easing in response to the date-0 shock on corporate capital structure and thus future (date-1) financial stress. In the extreme, perfect stabilization generates a potentially large corporate recession in the next period. More broadly, if the central bank balances the current and future output loss, it will set R_0 above R^*, trading off a Keynesian (demand-side) recession at $t = 0$ in order to mitigate the corporate (supply-side) recession at $t = 1$.

Figure 8 illustrates the intertemporal tradeoff in the simplest way; in Section 4.3 below, we derive the resulting optimal monetary policy. Aggressive easing can close the contemporaneous output gap, but only by inducing leverage that lowers next period's natural output. More restrained easing accepts a larger demand shortfall and recession today in ex-

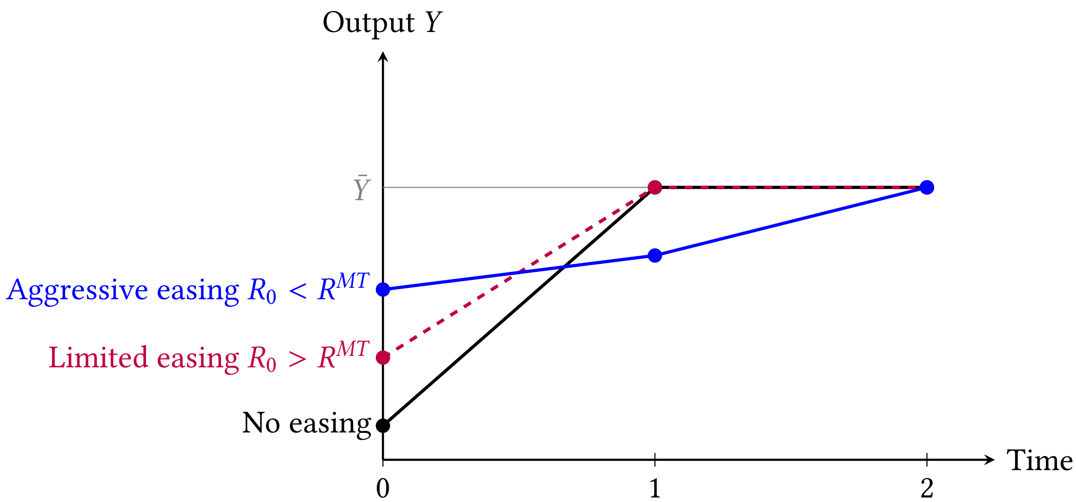

Figure 8: Intertemporal tradeoff: stabilizing current output via aggressive easing can induce future indebted supply and a slower recovery.

change for preserving future supply capacity and avoiding a corporate recession tomorrow. We summarize this discussion in the following proposition:

Proposition 5 (Financial dominance and the response to demand shocks)**.** *Suppose the initial state is F_{-1} and consider an unanticipated shock to households' date-0 discount factor β_0, which then reverts permanently to its steady state value β at $t = 1$.*

(i) ***Divine coincidence:*** *For moderate demand shocks*

$$\beta_0 \in [1/\bar{R}(F_{-1}), 1/R^{MT}],$$

the central bank can achieve perfect macroeconomic stabilization at all dates $Y_0 = Y_1 = \bar{Y}$, $x_0 = x_1 = 1$, with zero inflation, by setting $R_0 = 1/\beta_0$.

(ii) ***Financial dominance and overheating****: For sufficiently large positive demand shocks*

$$\beta_0 < 1/\bar{R}(F_{-1}),$$

it is impossible to have both $Y_0 = \bar{Y}$ and zero inflation at $t = 0$. Setting $R_0 = 1/\beta_0$ achieves $Y_0 = \bar{Y}$, but implies positive inflation.

- *For $\beta_0 \in [\underline{\beta}(F_{-1}), 1/\bar{R}(F_{-1})]$ where $\underline{\beta}(F_{-1}) = \left(\frac{Y}{\nu}\right)^{\nu}\left(\frac{F_{-1}}{1-\nu}\right)^{1-\nu}$, there exists a rate R_0 that achieves zero inflation at $t = 0$, but at the cost of a drop in output $Y_0 < \bar{Y}$.*

- *For $\beta_0 < \underline{\beta}(F_{-1})$, no choice of R_0 can deliver zero inflation at $t = 0$.*

(iii) ***Financial dominance and recessions****: For sufficiently large negative demand shocks*

$$\beta_0 > 1/R^{MT},$$

monetary policy can achieve perfect stabilization at $t = 0$ ($Y_0 = \bar{Y}$ and no inflation) if and only if R_0 is equal to the unique solution R_0^{stab} to equation (28). R_0^{stab} is below $1/\beta_0$, decreases with β_0, increases with $\bar{x}$, and decreases with κ in the specification $R_0^E = R_0 + \kappa$. However, setting $R_0 = R_0^*$ to achieve $Y_0 = \bar{Y}$ necessarily entails indebted supply and a corporate recession in the next period, $x_1 < 1$.

Other shocks: fiscal policy, supply shocks, and financial shocks. Proposition 5 focuses on demand shocks arising from households' discount factor. Fiscal shocks and other disturbances generate analogous regime shifts. Appendix A.2 provides the corresponding expressions for government spending shocks and for supply shocks (changes in A or γ), highlighting that indebted supply amplifies inflationary pressures even when policy is sufficiently reactive to stabilize contemporaneous output.

Alternative credit-bites-back mechanisms. Stein (2013) offers an early policy discussion of "overheating" episodes when credit risk appears to be priced unusually cheaply and of the idea that monetary policy, by affecting broad financial conditions, can influence leverage creation throughout the economy. Kashyap and Stein (2023) formalize a related "credit-bites-back" mechanism, in which rate cuts compress credit spreads today but increase the risk of a future spread reversal that may be difficult to offset (e.g., if the ZLB binds). Our mechanism provides a micro-founded channel through which policy can induce leverage creation via market timing, but it differs in a key dimension: while Kashyap and Stein (2023) abstract from inflation and focus on the IS curve, our intertemporal trade-off operates through future *aggregate supply* (via x_1) and therefore generates future output losses even away from the ZLB.

Time-consistency. In a different context, Farhi and Tirole (2012) highlight financial institutions' incentives to increase their maturity mismatch and correlated exposures when they anticipate future expansionary monetary policy, which can be seen as a form of untargeted bailout. Their focus is on the lack of policy commitment which can lead to multiple, self-fulfilling, equilibria. By contrast, in Proposition 3 firms' choice of optimal continuation x_1 depends on *current* rates and spreads, and not on what firms expect about future policy, hence lack of commitment is not an issue.[14]

The role of household expectations. Propositions 4 and 5 rely on households anticipating at least partly that market-timing leverage lowers future income via $x_1 < 1$. We frame this intuition in the standard New Keynesian tradition emphasizing intertemporal substitution, but an equivalent interpretation is that the future financial distress $x_1 < 1$ creates a negative wealth effect that undermines consumption, as in Chodorow-Reich, Nenov and Simsek (2021) and Caballero and Simsek (2024). Appendix A.3 introduces a simple underreaction parameter $\theta \in [0, 1]$ to scale how much households' consumption responds when anticipations may be sticky, with the limit $\theta \to 1$ capturing fully rational expectations.

4.3 Prudential easing

We now solve the *ex-ante* policy problem: current monetary policy affects future natural output by shifting firms' capital structure choices and therefore the continuation scale x_1. This creates an intertemporal tradeoff even when the current supply constraint does not bind (i.e., even when a static analysis would suggest that closing the contemporaneous output gap is sufficient for price stability). The Ramsey planner internalizes this effect and therefore has a prudential motive to limit leverage creation by "leaning against" aggressive easing.

To isolate this mechanism, consider a negative demand shock (high β_0) such that the usual New Keynesian stabilization motive calls for easing. Assume further that the *current* indebted-supply constraint does not bind at $t = 0$ (so $x_0 = 1$), while the *future* continuation scale x_1 depends on R_0 through firms' financing choices. With flexible prices at $t = 1$, output equals its natural level $Y_1 = x_1(R_0)^\nu \bar{Y}$ and hence

$$C_1 = Y_1 = x_1(R_0)^\nu \bar{Y}, \qquad C_0 = Y_0 = \frac{C_1}{\beta_0 R_0} = \frac{x_1(R_0)^\nu \bar{Y}}{\beta_0 R_0}. \tag{29}$$

[14] This stems from our assumption that only debt can be issued at $t + 1$, hence the only relevant return difference between debt and equity is about returns between t and $t + 1$.

Since $x_0 = 1$, the date-0 output gap is

$$G_0(R_0) = \frac{x_1(R_0)^\nu}{\beta_0 R_0}. \tag{30}$$

Date-0 labor is $N_0 = \mathcal{N}(G_0(R_0))$ as in (A.1). At $t = 1$, the economy is flexible-price and labor equals its steady-state value $\bar{N}$; thus period-1 labor disutility is constant. For this analysis, we assume that the central bank follows a standard objective of maximizing

$$W(R_0) = \log C_0 - \chi \mathcal{N}(G_0(R_0)) + \beta_0 \left[\log C_1 - \chi \bar{N}\right],$$

with C_0, C_1 from (29).[15] Differentiating yields

$$\frac{dW}{dR_0} = \frac{M(G_0) - 1}{R_0} + \nu \frac{x_1'(R_0)}{x_1(R_0)} \Big(1 + \beta_0 - M(G_0)\Big), \tag{31}$$

where $M(G) \equiv \chi \mathcal{N}'(G) G$ from (17). The first term in (31) is the standard stabilization motive: when $M(G_0) < 1$ (slack), lowering R_0 raises welfare; when $M(G_0) > 1$ (overheating), raising R_0 raises welfare. The second term is the novel prudential motive: when $x_1'(R_0) > 0$ (i.e., $R_0 < R^{MT}$ and lower rates induce more leverage and hence a lower x_1), easing today reduces future natural output and thereby lowers welfare. Hence the Ramsey optimum satisfies $M(G_0) < 1$ and therefore implements deliberate contemporaneous slack ($G_0 < 1$). Equivalently, the planner chooses *less easing* than would be required to fully stabilize the period-0 allocation.

To make the comparison precise, recall that the natural rate R_0^n is defined as the policy rate that closes both the date-0 output gap and inflation, i.e., such that $Y_0 = \bar{Y}$ (in this region such that $R_0 < \bar{R}(F_{-1})$, hence the date-0 supply constraint does not bind). The following proposition shows that even though the divine coincidence holds contemporaneously in the sense that the central bank is able to achieve both full employment and no inflation at $t = 0$, the Ramsey planner chooses $R_0^{opt} > R_0^n$, trading off imperfect stabilization today against preserving future supply capacity.

[15] In other words, we assume that the central bank does not try to manipulate corporate leverage in order to increase welfare from debtholdings. The simplest interpretation is that the wedge captures a transfer between agents that nets out from aggregate welfare; for instance, in the additive specification $R_0^E = R_0 + \kappa$, if κ is only a transfer between agents. In alternative foundations for the wedge, for instance stemming from a convenience yield on debt, the central bank could have an additional "monetarist" motive (which underlies, for instance, the Friedman rule) to lower rates to increase the supply of corporate debt and thus convenience. We view this motive as somewhat orthogonal to our framework, as tackling this question would require modeling alternative ways of supplying convenient assets by issuing government debt or money.

Proposition 6 (Prudential monetary easing)**.** *Consider a negative demand shock (high* β_0*) such that* $1/\beta_0 < R^{MT}$*. Then the Ramsey-optimal policy* R_0^{opt} *solves*

$$M(G_0(R_0^{opt})) = \frac{1 - \nu R_0 \frac{x_1'(R_0^{opt})}{x_1(R_0^{opt})}(1+\beta_0)}{1 - \nu R_0 \frac{x_1'(R_0^{opt})}{x_1(R_0^{opt})}} < 1$$

and therefore satisfies

$$R_0^{opt} > R_0^n,$$

implementing deliberate contemporaneous slack, $G_0(R_0^{opt}) < 1$.

Proposition 6 shows that absent targeted macroprudential tools, optimal monetary policy is prudential: it trades off contemporaneous stabilization against preserving future supply capacity. Even with *unconstrained rate cuts* (i.e., no risk of hitting the ZLB in the next period) and *no financial stability mandate*, optimal monetary policy internalizes that easing shifts the corporate capital structure and lowers future natural output. Leaning against leverage induced by low rates requires a larger contemporaneous contraction in order to preserve future supply capacity. This perspective is also closely related in spirit to Stein (2013)'s argument that monetary policy can affect credit market conditions broadly, although in our model the prudential motive arises from a supply-side intertemporal tradeoff rather than from an explicit financial-stability objective. Appendix A.9 shows how allowing for an additional policy instrument that limits or taxes corporate leverage can decouple the two objectives and restore the standard mandate of monetary policy.

Unlike much of the literature on "leaning against the wind", our prudential motive does not rely on zero lower bound concerns or financial instability externalities. Even if the central bank has unlimited rate-cutting capacity and faces no financial stability mandate, it optimally restrains easing to preserve future supply capacity. The key is that the intertemporal tradeoff operates through aggregate supply, which cannot be undone by future policy once prices become flexible. In fact, since $x_1(R_0)$ is kinked at R_{MT}, the Ramsey optimum R_0^{opt} may even occur exactly at R^{MT}, i.e., the planner may optimally refuse to cut rates below R^{MT} even in the absence of a ZLB.

Figure 9 compares three interest-rate policies as a function of the demand shock, as measured by the frictionless natural rate $1/\beta_0$. The benchmark policy $R_0 = 1/\beta_0$ ignores completely that low rates shift corporate leverage and reduce future productive capacity through x_1. The contemporaneous natural rate R_0^n is more accommodative, as the negative

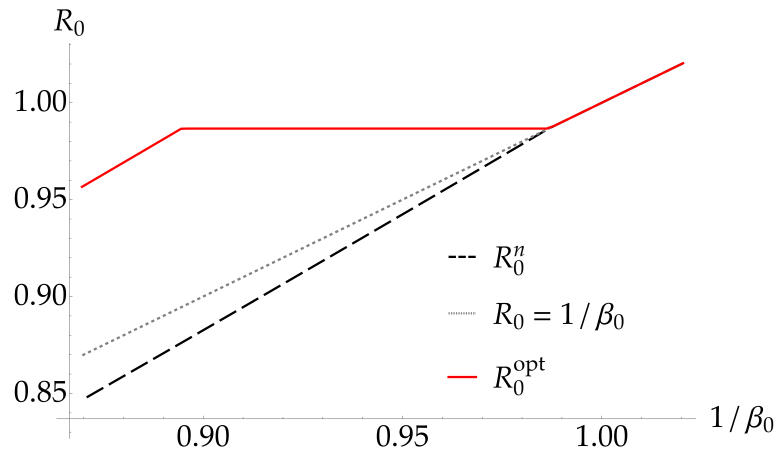

Figure 9: Policy rates. The x-axis is the frictionless New Keynesian natural rate $1/\beta_0$ associated with the date-0 demand shock β_0. Dashed black line: Natural rate $R_0 = R_0^n$ (such that $Y_0 = \bar{Y}$) in the full model. Dotted gray line: frictionless New Keynesian natural rate $R_0 = 1/\beta_0$. Solid red line: Optimal prudential policy R_0^{opt}.

impact of easing on x_1 means that a lower date-0 rate is required to achieve $Y_0 = \bar{Y}$. Finally, the optimal "prudential" rate R_0^{opt} internalizes the full intertemporal supply effect of easing and satisfies $R_0^{\text{opt}} > R_0^n$, implying deliberate contemporaneous slack $G_0(R_0^{\text{opt}}) < 1$. As noted above, the kink in $x_1(R_0)$ implies that there is a range of demand shocks for which the optimal rate is constant, equal to $R_0^{opt} = R^{MT}$.

Figure 10 translates these policy stances into output dynamics. The contemporaneous stabilization policy R_0^n closes the date-0 gap but does so by inducing a larger shift toward debt financing, which lowers next period's continuation scale x_1 and therefore reduces future output $Y_1 = x_1(R_0)^\nu \bar{Y}$. The Ramsey planner instead chooses less easing and tolerates $Y_0 < \bar{Y}$ so as to protect future capacity x_1, delivering a faster recovery in Y_1.

Interestingly, our result on prudential monetary policy is less reliant on forward-looking anticipations by households than Proposition (4) on self-defeating monetary easing. Appendix A.3 shows that even though underreaction of household expectations attenuates the private demand-feedback channel, the planner's prudential motive remains because welfare depends on actual future consumption $C_1 = x_1^\nu \bar{Y}$.

5 Conclusion

We introduced a tractable New Keynesian framework in which corporate capital structures interact with monetary policy through two channels: *indebted supply* (ex-post, outstand-

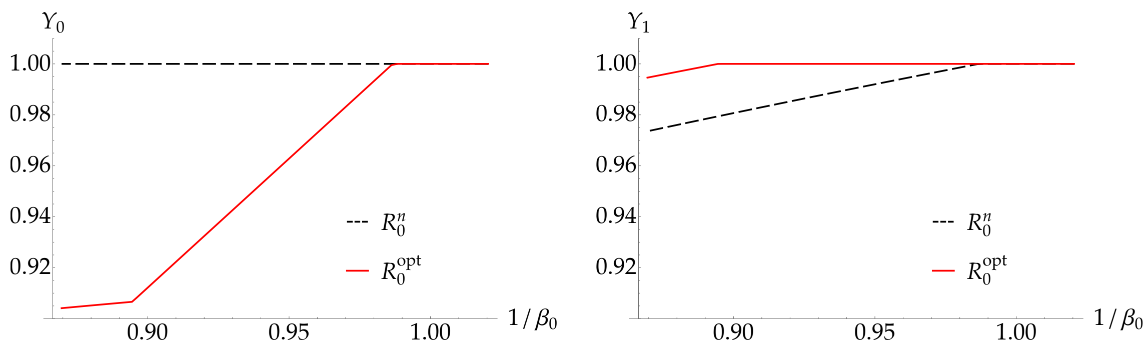

Figure 10: Output consequences. The figure plots date-0 output $Y_0/\bar{Y}$ (left panel) and date-1 output $Y_1/\bar{Y}$ (right panel) as functions of the frictionless New Keynesian natural rate $1/\beta_0$ under two policies. Dashed black line: Contemporaneous stabilization $R_0 = R_0^n$ (such that $Y_0 = \bar{Y}$). Solid red line: Optimal prudential policy R_0^{opt}.

ing debt reduces firms' remaining debt capacity and makes production more interest-rate sensitive) and *market timing* (ex-ante, changes in the policy rate shift the relative cost of debt and equity and thereby firms' leverage choices). These channels generate a form of financial dominance, in which the inflation-output tradeoff faced by the central bank depends on the state of corporate balance sheets and on how policy affects future financial constraints. Unlike fiscal dominance, where fiscal policy constraining inflation control or requiring monetary accommodation, financial dominance in our model arises under a standard inflation–output mandate.

The model delivers two central policy implications. First, when firms are highly levered, aggregate supply becomes kinked: tightening contracts both demand and supply. Price stability requires larger output contractions than in the canonical New Keynesian model. While the rate required for price stability rises with outstanding debt, the welfare-maximizing rate can fall. Tolerating higher inflation in high-leverage states avoids further tightening supply constraints.

Second, when low rates induce firms to lever up, monetary policy becomes intrinsically intertemporal even when a static analysis would suggest divine coincidence. In particular, aggressive easing that closes contemporaneous output gaps can tighten future supply constraints and worsen future stabilization tradeoffs. The case for policy restraint does not depend on zero lower bound constraints or financial stability mandates: it arises purely from the supply-side channel, providing a new foundation for prudential monetary policy.

Our analysis focuses on corporate debt and aggregate supply. A natural question is how financial dominance interacts with other channels through which debt constrains monetary policy. Recent work emphasizes that household balance sheets can make aggregate demand history-dependent (Mian et al., 2021). Indebted demand and indebted supply have opposite implications for future policy rates: the former calls for lower rates to stimulate spending, the latter for higher rates to control inflation. These forces need not offset and can reinforce each other across episodes. For instance, prolonged accommodation aimed at supporting indebted demand may encourage corporate leverage through market timing, tightening future supply constraints. Mortgage lock-in may further weaken the contractionary effect of rate hikes on household demand (Fonseca and Liu, 2024; Fonseca et al., 2025), potentially requiring larger increases in policy rates to achieve a given reduction in inflation and thus amplifying the indebted supply channel. Integrating corporate and household debt in a unified framework is a promising direction for future work.

References

Abadi, Joseph, Markus Brunnermeier, and Yann Koby (2023), "The Reversal Interest Rate", *American Economic Review*, Vol. 113, pp. 2084–2120.

Acharya, Viral V., Soku Byoun, and Zhaoxia Xu (2024), "The Sensitivity of Cash Saving to the Cost of Capital", working paper.

Adrian, Tobias and Hyun Song Shin (2010), "Financial Intermediaries and Monetary Economics", in Benjamin M. Friedman and Michael Woodford eds. *Handbook of Monetary Economics*, Vol. 3: Elsevier, 1st edition, Chap. 12, pp. 601–650.

Afrouzi, Hassan, Saroj Bhattarai, and Edson Wu (2024), "Relative-price changes as aggregate supply shocks revisited: Theory and evidence", *Journal of Monetary Economics*, p. 103650.

Baker, Malcolm, Robin Greenwood, and Jeffrey Wurgler (2003), "The maturity of debt issues and predictable variation in bond returns", *Journal of Financial Economics*, Vol. 70, pp. 261–291.

Baker, Malcolm and Jeffrey Wurgler (2002), "Market Timing and Capital Structure", *The Journal of Finance*, Vol. 57, pp. 1–32.

Baqaee, David R., Emmanuel Farhi, and Kunal Sangani (2024), "The Supply-Side Effects of Monetary Policy", *Journal of Political Economy*, Vol. 132, pp. 1065–1112.

Barth, Marvin J. and Valerie A. Ramey (2001), "The Cost Channel of Monetary Transmission", *NBER Macroeconomics Annual*, Vol. 16, pp. 199–240.

Benigno, Pierpaolo and Gauti B Eggertsson (2024), "The Slanted-L Phillips Curve", Working Paper 32172, National Bureau of Economic Research.

Berger, David, Joseph Vavra, Konstantin Milbradt, and Fabrice Tourre (2021), "Mortgage prepayment and path-dependent effects of monetary policy", *American Economic Review*, Vol. 111, pp. 2829–78.

Bernanke, Ben and Mark Gertler (1989), "Agency Costs, Net Worth, and Business Fluctuations", *The American Economic Review*, Vol. 79, pp. 14–31.

Bernanke, Ben S. and Alan S. Blinder (1988), “Credit, Money, and Aggregate Demand”, *The American Economic Review*, Vol. 78, pp. 435–439.

Bernanke, Ben S., Mark Gertler, and Simon Gilchrist (1999), “Chapter 21 The financial accelerator in a quantitative business cycle framework”, Vol. 1 of Handbook of Macroeconomics: Elsevier, pp. 1341–1393.

Bernanke, Ben S. and Kenneth N. Kuttner (2005), “What Explains the Stock Market’s Reaction to Federal Reserve Policy?”, *The Journal of Finance*, Vol. 60, pp. 1221–1257.

Blanchard, Olivier and Jordi Galí (2007), “Real Wage Rigidities and the New Keynesian Model”, *Journal of Money, Credit and Banking*, Vol. 39, pp. 35–65.

Bolton, Patrick, Hui Chen, and Neng Wang (2011), “A Unified Theory of Tobin’s q, Corporate Investment, Financing, and Risk Management”, *The Journal of Finance*, Vol. 66, pp. 1545–1578.

Borio, Claudio and Haibin Zhu (2012), “Capital regulation, risk-taking and monetary policy: A missing link in the transmission mechanism?”, *Journal of Financial Stability*, Vol. 8, pp. 236–251.

Caballero, Ricardo J. and Alp Simsek (2024), “Central Banks, Stock Markets, and the Real Economy”, *Annual Review of Financial Economics*.

Cerra, Valerie and Sweta Chaman Saxena (2008), “Growth Dynamics: The Myth of Economic Recovery”, *American Economic Review*, Vol. 98, pp. 439–57.

Chaney, Thomas, David Sraer, and David Thesmar (2012), “The Collateral Channel: How Real Estate Shocks Affect Corporate Investment”, *American Economic Review*, Vol. 102, pp. 2381–2409.

Chodorow-Reich, Gabriel, Plamen T. Nenov, and Alp Simsek (2021), “Stock Market Wealth and the Real Economy: A Local Labor Market Approach”, *American Economic Review*, Vol. 111, pp. 1613–57.

Christiano, Lawrence J., Martin Eichenbaum, and Charles L. Evans (2005), “Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy”, *Journal of Political Economy*, Vol. 113, pp. 1–45.

Cloyne, James, Clodomiro Ferreira, Maren Froemel, and Paolo Surico (2023), "Monetary Policy, Corporate Finance, and Investment", *Journal of the European Economic Association*, Vol. 21, pp. 2586–2634.

Di Tella, Sebastian, Benjamin M Hébert, Pablo Kurlat, and Qitong Wang (2023), "The Zero-Beta Interest Rate", Working Paper 31596, National Bureau of Economic Research.

Diamond, William (2020), "Safety Transformation and the Structure of the Financial System", *The Journal of Finance*, Vol. 75, pp. 2973–3012.

Donaldson, Jason Roderick, Denis Gromb, and Giorgia Piacentino (2022), "Conflicting Priorities: A Theory of Covenants and Collateral", working paper.

Drechsler, Itamar, Alexi Savov, and Philipp Schnabl (2017), "The Deposits Channel of Monetary Policy*", *The Quarterly Journal of Economics*, Vol. 132, pp. 1819–1876.

——— (2022), "Credit Crunches and the Great Stagflation", working paper.

Eggertsson, Gauti B. and Paul Krugman (2012), "Debt, Deleveraging, and the Liquidity Trap: A Fisher-Minsky-Koo Approach*", *The Quarterly Journal of Economics*, Vol. 127, pp. 1469–1513.

Eggertsson, Gauti B. and Michael Woodford (2003), "The Zero Bound on Interest Rates and Optimal Monetary Policy", *Brookings Papers on Economic Activity*, Vol. 34, pp. 139–235.

Eichenbaum, Martin, Sergio Rebelo, and Arlene Wong (2022), "State-Dependent Effects of Monetary Policy: The Refinancing Channel", *American Economic Review*, Vol. 112, pp. 721–61.

Eisfeldt, Andrea L. and Tyler Muir (2016), "Aggregate external financing and savings waves", *Journal of Monetary Economics*, Vol. 84, pp. 116–133.

Fang, Chuck (2025), "Monetary Policy Amplification through Bond Fund Flows", working paper, Jacobs Levy Equity Management Center for Quantitative Financial Research.

Farhi, Emmanuel and Jean Tirole (2012), "Collective Moral Hazard, Maturity Mismatch, and Systemic Bailouts", *American Economic Review*, Vol. 102, pp. 60–93.

Farhi, Emmanuel and Iván Werning (2016), "A Theory of Macroprudential Policies in the Presence of Nominal Rigidities", *Econometrica*, Vol. 84, pp. 1645–1704.

Fonseca, Julia and Lu Liu (2024), "Mortgage Lock-In, Mobility, and Labor Reallocation", *The Journal of Finance*, Vol. 79, pp. 3729–3772.

Fonseca, Julia, Lu Liu, and Pierre Mabille (2025), "Unlocking mortgage lock-in: Evidence from a spatial housing ladder model", *Available at SSRN 4874654*.

Fornaro, Luca (2024), "Fiscal Stimulus with Supply Constraints", crei working paper.

Froot, Kenneth A., David S. Scharfstein, and Jeremy C. Stein (1993), "Risk Management: Coordinating Corporate Investment and Financing Policies", *The Journal of Finance*, Vol. 48, pp. 1629–1658.

Gabaix, Xavier and Ralph S. J. Koijen (2021), "In Search of the Origins of Financial Fluctuations: The Inelastic Markets Hypothesis", Working Paper 28967, National Bureau of Economic Research.

Galí, Jordi (2015), *Monetary Policy, Inflation, and the Business Cycle: An Introduction to the New Keynesian Framework and Its Applications Second edition* in , Economics Books, No. 10495: Princeton University Press.

Gilchrist, Simon, Raphael Schoenle, Jae Sim, and Egon Zakrajsek (2017), "Inflation Dynamics during the Financial Crisis", *American Economic Review*, Vol. 107, pp. 785–823.

Graham, John R and Campbell R Harvey (2001), "The theory and practice of corporate finance: evidence from the field", *Journal of Financial Economics*, Vol. 60, pp. 187–243, Complementary Research Methodologies: The InterPlay of Theoretical, Empirical and Field-Based Research in Finance.

Greenwood, Robin, Samuel G Hanson, and Lawrence J Jin (2023), "Reflexivity in Credit Markets", Working Paper 25747, National Bureau of Economic Research.

Greenwood, Robin, Samuel Hanson, and Jeremy C. Stein (2010), "A Gap-Filling Theory of Corporate Debt Maturity Choice", *The Journal of Finance*, Vol. 65, pp. 993–1028.

Guerrieri, Veronica and Guido Lorenzoni (2017), "Credit Crises, Precautionary Savings, and the Liquidity Trap*", *The Quarterly Journal of Economics*, Vol. 132, pp. 1427–1467.

Guerrieri, Veronica, Guido Lorenzoni, Ludwig Straub, and Iván Werning (2021), "Monetary Policy in Times of Structural Reallocation", *Proceedings of the Jackson Hole Economic Policy Symposium.*

Hartman-Glaser, Barney, Simon Mayer, and Konstantin Milbradt (2022), "A Theory of Cash Flow-Based Financing with Distress Resolution", Working Paper 29712, National Bureau of Economic Research.

Hennessy, Christopher A. and Toni M. Whited (2007), "How Costly Is External Financing? Evidence from a Structural Estimation", *The Journal of Finance*, Vol. 62, pp. 1705–1745.

Holmström, Bengt and Jean Tirole (1998), "Private and public supply of liquidity", *Journal of Political Economy*, Vol. 106, pp. 1–40.

Hugonnier, Julien, Semyon Malamud, and Erwan Morellec (2014), "Capital Supply Uncertainty, Cash Holdings, and Investment", *The Review of Financial Studies*, Vol. 28, pp. 391–445.

Ivashina, Victoria, Sebnem Kalemli-Ozcan, Luc Laeven, and Karsten Mueller (2024), "Corporate Debt, Boom-Bust Cycles, and Financial Crises", Working Paper 32225, National Bureau of Economic Research.

Jeenas, Priit (2024), "Firm Balance Sheet Liquidity, Monetary Policy Shocks, and Investment Dynamics", working paper.

Jermann, Urban and Vincenzo Quadrini (2012), "Macroeconomic Effects of Financial Shocks", *American Economic Review*, Vol. 102, pp. 238–71.

Jiménez, Gabriel, Dmitry Kuvshinov, José-Luis Peydró, and Bjorn Richter (2023), "Monetary Policy, Inflation, and Crises: Evidence from History and Administrative Data", working paper.

Kashyap, Anil K., Owen A. Lamont, and Jeremy C. Stein (1994), "Credit Conditions and the Cyclical Behavior of Inventories", *Quarterly Journal of Economics*, Vol. 109, pp. 565–592.

Kashyap, Anil K and Jeremy C. Stein (2000), "What Do a Million Observations on Banks Say about the Transmission of Monetary Policy?", *The American Economic Review*, Vol. 90, pp. 407–428.

——— (2023), "Monetary Policy When the Central Bank Shapes Financial-Market Sentiment", *Journal of Economic Perspectives*, Vol. 37, pp. 53–76.

Kashyap, Anil K., Jeremy C. Stein, and David W. Wilcox (1993), "Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance", *The American Economic Review*, Vol. 83, pp. 78–98.

Kiyotaki, Nobuhiro and John Moore (1997), "Credit Cycles", *Journal of Political Economy*, Vol. 105, pp. 211–248.

Koijen, Ralph S. J. and Motohiro Yogo (2019), "A Demand System Approach to Asset Pricing", *Journal of Political Economy*, Vol. 127, pp. 1475–1515.

Krishnamurthy, Arvind and Wenhao Li (2024), "Dissecting Mechanisms of Financial Crises: Intermediation and Sentiment", Working Paper 27088, National Bureau of Economic Research.

López-Salido, David, Jeremy C. Stein, and Egon Zakrajsek (2017), "Credit-Market Sentiment and the Business Cycle*", *The Quarterly Journal of Economics*, Vol. 132, pp. 1373–1426.

Ma, Yueran (2019), "Nonfinancial Firms as Cross-Market Arbitrageurs", *The Journal of Finance*, Vol. 74, pp. 3041–3087.

Mabille, Pierre and Olivier Wang (2022), "Intermediary-based loan pricing".

McKay, Alisdair and Johannes F. Wieland (2021), "Lumpy Durable Consumption Demand and the Limited Ammunition of Monetary Policy", *Econometrica*, Vol. 89, pp. 2717–2749.

Mian, Atif, Ludwig Straub, and Amir Sufi (2021), "Indebted Demand*", *The Quarterly Journal of Economics*, Vol. 136, pp. 2243–2307.

Milgrom, Paul and Chris Shannon (1994), "Monotone Comparative Statics", *Econometrica*, Vol. 62, pp. 157–180.

Mota, Lira (2023), "The Corporate Supply of (Quasi) Safe Assets", *Available at SSRN 3732444.*

Myers, Stewart C. and Nicholas S. Majluf (1984), "Corporate financing and investment decisions when firms have information that investors do not have", *Journal of Financial Economics*, Vol. 13, pp. 187–221.

Ottonello, Pablo and Thomas Winberry (2020), "Financial Heterogeneity and the Investment Channel of Monetary Policy", *Econometrica*, Vol. 88, pp. 2473–2502.

Rampini, Adriano A. and S. Viswanathan (2010), "Collateral, Risk Management, and the Distribution of Debt Capacity", *The Journal of Finance*, Vol. 65, pp. 2293–2322.

Ravenna, Federico and Carl E. Walsh (2006), "Optimal monetary policy with the cost channel", *Journal of Monetary Economics*, Vol. 53, pp. 199–216.

Reinhart, Carmen M. and Kenneth S. Rogoff (2009), *This Time Is Different: Eight Centuries of Financial Folly*, Vol. 1 of Economics Books: Princeton University Press.

Rubbo, Elisa (2024), "What drives inflation? Lessons from disaggregated price data", working paper.

Schmitt-Grohé, Stephanie and Martín Uribe (2016), "Downward Nominal Wage Rigidity, Currency Pegs, and Involuntary Unemployment", *Journal of Political Economy*, Vol. 124, pp. 1466–1514.

Smith, Clifford W. and Jerold B. Warner (1979), "On financial contracting: An analysis of bond covenants", *Journal of Financial Economics*, Vol. 7, pp. 117–161.

Stein, Jeremy C. (2013), "Overheating in Credit Markets: Origins, Measurement, and Policy Responses", Speech, Board of Governors of the Federal Reserve System, February, Remarks at "Restoring Household Financial Stability after the Great Recession: Why Household Balance Sheets Matter," Federal Reserve Bank of St. Louis, February 7.

Wang, Olivier (2025), "Banks, Low Interest Rates, and Monetary Policy Transmission", *The Journal of Finance*, Vol. 80, pp. 1379–1416.

Werning, Ivan (2011), "Managing a Liquidity Trap: Monetary and Fiscal Policy", NBER Working Papers 17344, National Bureau of Economic Research, Inc.

Online Appendix

A Additional Results and Extensions

A.1 Aggregate labor

Aggregate labor demand is the sum of the labor demand by the mass λ of firms able to reset their price according to Lemma 1, and the labor demand by the mass $1-\lambda$ of firms stuck with a relative price $\bar{p}(G)$. Under the labor subsidy $\tau = 1/\epsilon$, the desired reset price satisfies $p^*(G) = G^\phi$ and the price index definition implies $\bar{p}(G)^{1-\epsilon} = \frac{1-\lambda G^{-\phi(\epsilon-1)}}{1-\lambda}$. Denoting $G_t = \frac{Y_t}{x_t^\nu \bar{Y}}$ the output gap, equilibrium aggregate labor can be written as a function $\mathcal{N}$ of the output gap:

$$N_t = \mathcal{N}(G_t) = \bar{N} G_t^{\frac{1}{1-\alpha}} \cdot \Delta(G_t), \tag{A.1}$$

where $\bar{N} = \frac{1-\alpha}{\chi}$ is the first-best labor supply that would prevail under flexible prices, the second term $G^{\frac{1}{1-\alpha}}$ captures the potential "overheating" of the economy if equilibrium output Y is higher than natural output $x^\nu \bar{Y}$, and

$$\Delta(G) = \lambda\, G^{-\frac{\phi\epsilon}{1-\alpha}} + (1-\lambda)\, [\bar{p}(G)]^{-\frac{\epsilon}{1-\alpha}}, \tag{A.2}$$

is a measure of the labor dispersion (and therefore misallocation, since all firms have the same marginal cost) resulting from price stickiness.

A.2 Other shocks

Fiscal shocks. Proposition 5 focuses on demand shocks arising from households' discount factor. Fiscal shocks such as increases in government spending G_0 have a very similar effect.

Suppose a date-0 public-spending shock $\mathcal{G}_0 > 0$. Aggregate demand still determines output $Y_0 = \mathcal{G}_0 + C_0$, and in the relevant range of interest rates $R_0 > 1/\beta$, we have $C_0 = \bar{Y}/(\beta R_0)$. The policy rate that leaves output unchanged at $Y_0 = \bar{Y}$ is:

$$R_0 = \frac{\bar{Y}}{\beta(\bar{Y} - \mathcal{G}_0)}. \tag{A.1$'$}$$

In a New Keynesian model without financial frictions, the central bank could offset any inflationary effects of the fiscal stimulus by stabilizing output. However, indebted supply implies that under this monetary policy reaction, the fiscal shock is still inflationary as x_0 falls below 1. If we start from the steady-state leverage (so that $F_{-1} = \beta - \gamma$), then $x_0 = 1 - \beta \mathcal{G}_0/(\gamma \bar{Y})$, so inflation increases with the size of government spending.

Therefore, our framework predicts that a fiscal shock can cause inflation in spite of monetary tightening that is sufficiently reactive to keep output at its potential. Moreover, the inflationary consequences are larger if firms have borrowed a lot recently, for instance following a period of low rates.

Supply shocks. We now consider how financial dominance affects the response of monetary policy to *supply* shocks. Our model features two potential sources of negative supply shocks: a fall in total factor productivity A, or an increase in the reinvestment need γ. At a general level, both can be viewed as an adverse shift in the production possibility frontier once we take into account the two stages of production.

A negative date-0 shock on productivity A_0 is a pure downward shift in potential output $\bar{Y}_0$, that leaves the threshold interest rate $\bar{R}(F_{-1})$ (corresponding to the kink in the aggregate supply curve) unchanged; in Figure 2 this corresponds to a parallel fall in the red aggregate supply curve Y_0^s. As in the standard (one-sector) New Keynesian model, a transitory negative shock to A_0 implies an increase in the natural interest rate. This is because the economy is expected to grow back to a higher potential output, which means that in partial equilibrium (for a given rate R_0) households would like to borrow to smooth consumption between dates 0 and 1, hence in general equilibrium the interest rate must adjust upwards. Financial frictions imply that the natural rate increases by even more due to an adverse feedback loop. As the higher rate tightens firms' liquidity constraints and makes households poorer at $t = 0$, the desire to borrow from future income Y_1 is stronger. This adds to the upward pressure on the equilibrium rate, which further tightens firms' constraints, and so on.

The most interesting kind of negative supply shock takes the form an increase in γ_0, which can be interpreted as higher input prices (e.g., due to an energy crisis or supply chain disruptions) or as an unusual need to reorganize firms and reorient production, as was the case post-pandemic. Unlike in the case of a TFP shock, here potential output (i.e., the output that would prevail absent financial frictions) is unaffected and remains at its steady state level $\bar{Y}$, and monetary policy could decide to maintain $Y_0 = \bar{Y}$ by keeping its rate unchanged at the steady state rate $R = 1/\beta$. That would be inflationary, however, as the threshold rate $\bar{R}$ above which financial frictions bind is now lower. Figure A.1 shows how this corresponds to a leftward shift of the kink in the red aggregate supply curve Y_0^s

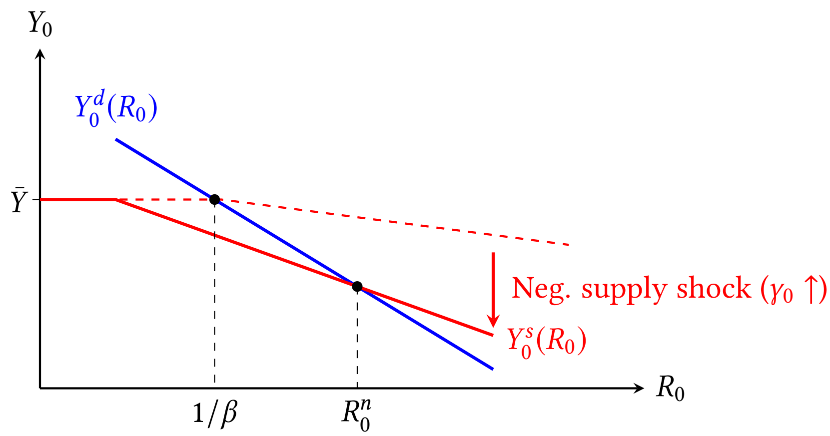

Figure A.1: Binding constraint ($x_0 < 1$) following a supply shock $\gamma_0 > \gamma$. R_0^n is the policy rate ensuring price stability after the shock.

, as well as a more negative slope in the downward sloping part. On the other side of the policy spectrum, ensuring price stability (and therefore replicating the flexible prices allocation) requires a higher interest rate (depicted as R^{**} in Figure A.1) and an even lower continuation x_0. In general, a central bank that seeks to stabilize both output and inflation will thus set an intermediate policy rate $R_0 < R^{**}$.

One difference with the case of a TFP shock is that maintaining "full employment", interpreted as ensuring $Y_0 = \bar{Y}_0$, requires a higher rate and a drop in output in the case of a fall in TFP A_0, whereas it calls for a stable interest rate and no drop in output in the case of an increase in γ_0. Hence nominal rigidities together with the proper monetary policy response have potentially larger welfare benefits following a shock to γ_0.

Financial shocks. We can also consider shocks that fall outside the standard demand and supply shocks in macroeconomics. Consider an increase in κ_0 that can be viewed as either a financial shock that makes equity and cash flow based claims particularly expensive, or a "flight to safety" shock that makes debt particularly cheap. Surprisingly, such a shock may affect date-0 output and inflation even though balance sheets are pre-determined, solely through its impact on *future* corporate balance sheets. In fact, we find that financial shocks that make debt more attractive have particularly damaging intertemporal effects: their directly make future supply more indebted, and are difficult to address with conventional monetary policy, as rate cuts amplify the shift towards debt.

To illustrate this channel in the simplest way, it is convenient to use the additive spread specification $R_0^E = R_0 + \kappa_0$. An increase in κ_0 can be interpreted as either a rise in the relative cost of equity financing or a “flight-to-debt” episode that makes debt unusually cheap. In this case, the market-timing threshold satisfies

$$R^{MT}(\kappa_0) = \frac{\kappa_0}{\bar{x}^{\,1-\nu} - 1},$$

so a higher κ_0 expands the region in which easing induces leverage and lowers x_1.

If firms' capital structures shift towards debt at $t = 0$, causing indebted supply at $t = 1$ and $x_1 < 1$, then the rise in κ_0 is effectively a negative demand shock at $t = 0$, and leads to a drop in output and deflation absent any monetary policy response, that is if R_0 is kept fixed. However, responding to the raise in κ_0 by easing monetary policy leads to the same dilemma as in Proposition 5, part (iii). The high spread κ_0 dampens the effect of monetary policy on output due to the endogenous response of corporate capital structures (Proposition 4). As a result, a more aggressive rate cut is required to stabilize output Y_0, but this can only be done at a larger cost in terms of future output Y_1.

Remark 5 (QE and large-scale asset purchases as wedge shocks). Large-scale asset purchases can be interpreted in our framework as policies that disproportionately compress yields on debt-like claims relative to equity, thereby strengthening market-timing incentives. In the model, such policies can be represented as an increase in κ (or, more generally, an increase in the wedge R_0^E/R_0 holding the household intertemporal price R_0 fixed). A larger wedge makes debt financing privately cheaper than equity, induces repurchases and leverage increases, and lowers the future continuation scale x_1. Through this channel, policies that reduce debt yields today can make future supply more vulnerable to a subsequent tightening.

A.3 Sticky household expectations

Some implications of the model operate purely through *supply* and do not rely on households anticipating future financial constraints. Other implications operate through a *demand* feedback: households expect that current leverage choices reduce future income, which dampens current spending and therefore weakens (or can even reverse) the short-run effect of monetary easing. A simple reduced-form way to parametrize the strength of the expectation channel is to allow households' expectations to *underreact* to news about future income. For instance, suppose that date-0 aggregate demand follows a generalization of the rational-expectations Euler equation $C_0 = C_1/(\beta_0 R_0)$:

$$C_0 = \frac{\tilde{C}_1}{\beta_0 R_0}, \qquad \tilde{C}_1 = \bar{Y}^{1-\theta} C_1^{\theta}, \quad \theta \in [0,1]. \tag{A.3}$$

When $\theta = 1$, we recover the standard rational-expectations equilibrium where households fully internalize the effect of future indebted supply on income. When $\theta = 0$, households behave as if future income is fixed at $\bar{Y}$ and do not generate a demand-side anticipation effect. Underreaction mitigates the demand-feedback component of Proposition 5: under (A.3), the date-0 IS curve becomes

$$Y_0 \;=\; \frac{x_1(R_0)^{\nu\theta}\,\bar{Y}}{\beta_0 R_0},$$

so that all expressions that rely on households fully internalizing future income effects carry through with ν replaced by $\nu\theta$ in the anticipation channel. In particular, the interest-rate elasticity of output in the market timing region becomes

$$-\frac{d\log Y_0}{d\log R_0} \;=\; 1 - \frac{\nu\theta}{1-\nu}\,\eta_g.$$

As $\theta \to 0$, the private demand-feedback from future indebted supply vanishes: monetary easing regains its standard contemporaneous power even though it may still induce leverage and reduce x_1. Importantly, the prudential policy tradeoff for the *planner* remains: even if households under-react to future income losses, the planner internalizes that lower x_1 reduces actual future consumption $C_1 = \bar{Y} x_1^{\nu}$. Thus the case for prudential monetary policy (Proposition 6) does not depend on sophisticated household expectations.

We now prove the claim (used in the main text) that the planner's prudential motive does not rely on fully rational household expectations. We maintain the setting of Section 4.3: the current supply constraint does not bind at $t = 0$ so $x_0 = 1$, prices are flexible from $t = 1$ onward, and the continuation scale $x_1 = x_1(R_0)$ is affected by market timing (so $x_1'(R_0) \geq 0$ with $x_1'(R_0) > 0$ in the market-timing region). At $t = 1$, the allocation is flexible-price, so actual consumption equals actual output

$$C_1 = Y_1 = x_1(R_0)^{\nu}\bar{Y}.$$

Substituting into the demand rule yields the implementability constraint

$$C_0 = Y_0 = \frac{x_1(R_0)^{\nu\theta}\bar{Y}}{\beta_0 R_0}, \qquad G_0(R_0) \equiv \frac{Y_0}{\bar{Y}} = \frac{x_1(R_0)^{\nu\theta}}{\beta_0 R_0}. \tag{A.4}$$

The planner maximizes welfare subject to (A.4). As in Section 4.3, period-1 labor disutility is constant and can be ignored, hence (up to constants) the planner's objective is

$$W(R_0) = \log C_0 - \chi \mathcal{N}(G_0(R_0)) + \beta_0 \log C_1.$$

From (A.4),

$$\frac{d\log C_0}{dR_0} = \nu\theta\frac{x_1'}{x_1} - \frac{1}{R_0}, \qquad \frac{d\log C_1}{dR_0} = \nu\frac{x_1'}{x_1}, \qquad \frac{dG_0}{dR_0} = G_0\Big(\nu\theta\frac{x_1'}{x_1} - \frac{1}{R_0}\Big).$$

Therefore

$$\frac{dW}{dR_0} = \Big(\nu\theta\frac{x_1'}{x_1} - \frac{1}{R_0}\Big) - \chi N'(G_0)\, G_0\Big(\nu\theta\frac{x_1'}{x_1} - \frac{1}{R_0}\Big) + \beta_0\nu\frac{x_1'}{x_1}.$$

Using $M(G_0) = \chi N'(G_0)G_0$ and rearranging yields the derivative of welfare with respect to R_0:

$$\frac{dW}{dR_0} = \frac{M(G_0) - 1}{R_0} + \nu\,\frac{x_1'(R_0)}{x_1(R_0)}\Big(\beta_0 + \theta - \theta M(G_0)\Big). \tag{A.5}$$

As in the baseline model (with $\theta = 1$), we define the (date-0) stabilization policy R_0^{stab} as the policy that closes the contemporaneous output gap, satisfying

$$G_0(R_0^{stab}) = 1 \iff x_1(R_0^{stab})^{\nu\theta} = \beta_0 R_0^{stab}. \tag{A.6}$$

At the stabilization point $G_0 = 1$, we have $M(1) = 1$. Evaluating (A.5) at R_0^{stab} therefore yields

$$\frac{dW}{dR_0}\bigg|_{R_0^{stab}} = \beta_0\nu\,\frac{x_1'(R_0^{stab})}{x_1(R_0^{stab})}.$$

If $x_1'(R_0^{stab}) > 0$, this derivative is strictly positive, so welfare is increasing in R_0 at R_0^{stab}. Hence the Ramsey optimum must satisfy $R_0^{opt} > R_0^{stab}$.

Notably, this conclusion is independent of θ; only the precise definition R_0^{stab} depends on θ. When $\theta < 1$, households underreact to the effect of x_1 on future income, so the *private* demand-feedback channel is attenuated. However, the planner still internalizes that market timing lowers *actual* future consumption $C_1 = x_1^{\nu}\bar{Y}$. Proposition 6 shows that this is sufficient to generate prudential leaning: even in the extreme case $\theta = 0$ (no private

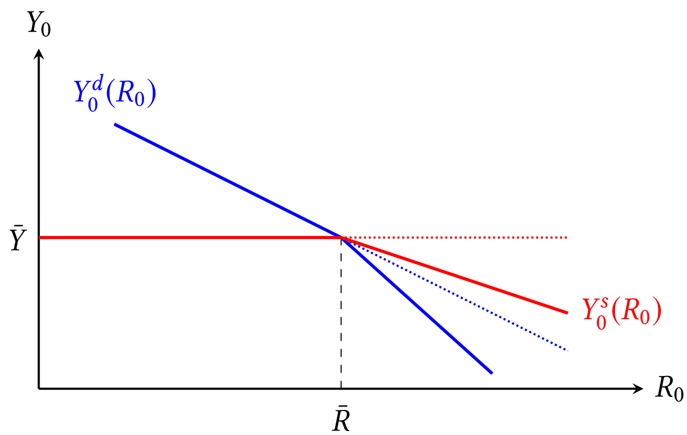

Figure A.2: Aggregate demand Y_0^d and aggregate supply Y_0^s as functions of R_0 when financial frictions also have demand effects. The dotted lines correspond to the frictionless New Keynesian model ($\nu = 0$).

anticipation), the planner prefers to raise R_0 relative to R_0^{stab} whenever $x_1'(R_0^{stab}) > 0$.

A.4 Demand effects from financial frictions

By design, our baseline model abstracts away from the well-understood effect of financial frictions on aggregate *demand*. In the model, this complete separation is due to two assumptions: the long-term investment scale K is fixed, and the reinvestment $\gamma x_{t+1} K$ is produced by competitive suppliers (e.g., commodities or imports).

Naturally, we can generalize the model by relaxing either of these two assumptions. Suppose, for instance, that a fraction $\omega > 0$ of the reinvestment need $\gamma x_{t+1} K$ is produced by firms with sticky prices instead of coming from endowments or competitive wholesalers with flexible prices. In that case, the market-clearing condition for output becomes

$$Y_t = \omega \gamma x_t K + C_t$$

where aggregate consumption C_t follows the same Euler equation (3) as before, and the new term $\omega \gamma x_t K$ corresponds to the "investment" part of aggregate demand.[16] As Figure A.2 shows, the only difference is that aggregate demand Y_0^d also has a more negative slope for rates $R_0 > \bar{R}$.

[16]We still assume that the long-term investment K is fixed. Making it interest-sensitive would simply add a third component to aggregate demand with similar implications.

A.5 Banks and credit crunches

Our baseline model contrasts the implications of different types of external finance for monetary policy transmission, but abstracts from financial intermediaries. “Debt” in our model can thus be interpreted as bank loans, non-bank loans, or corporate bonds, and firms’ binding constraints are due to previous leverage choices that limit the borrowers’ remaining pledgeable income or collateral.

Here we show how to extend our framework to allow for amplification originating in the banking sector, consistent with the empirical findings in Drechsler, Savov and Schnabl (2022), who argue that due to a regulatory cap on deposit rates (“Regulation Q”), monetary tightening in the 1970s led to stark deposit outflows and credit crunches that contracted aggregate supply.[17] Our model can incorporate those additional frictions by assuming that the reinvestment must be funded by bank loans paying not just the policy rate R_0 but a loan rate $R_0 + \rho(R_0)$ that includes an additional loan spread ρ.[18] It remains crucial that firms are unable to fund the reinvestment need by issuing equity against the operating cash flows. In that case, the continuation scale that determines ex-post aggregate supply becomes

$$x_0 = \min\left\{1; \frac{1}{\gamma}\left[\frac{1}{R_0 + \rho(R_0)} - F_{-1}\right]\right\}.$$

The key insight in Drechsler, Savov and Schnabl (2022) is that Regulation Q made the effective loan spread ρ particularly sensitive to monetary policy, with the positive derivative ρ' capturing the strength of the bank credit crunches induced by higher rates.

Denote R_Q the rate at which Regulation Q becomes binding.[19] Suppose that when R_0 is below R_Q, there is no loan spread and outstanding debt is small enough that $x_0 = 1$; but once R_0 exceeds R_Q, the loan spread ρ increases with R_0 with a slope ρ'. Then an increase in R_0 in the binding Regulation Q region is *inflationary* if

$$1 + \rho' > \frac{\gamma}{\beta\nu}$$

[17]Other work on the relation between monetary policy, bank lending and firms’ liquidity constraints includes Kashyap, Stein and Wilcox (1993), who show that monetary tightening shifts firms’ capital structure *within* debt types, from bank loans towards commercial paper, and Kashyap, Lamont and Stein (1994), who find that bank-dependent firms without internal liquidity saw an especially strong fall in their inventories during the 1981-1982 recession induced by monetary tightening.

[18]The loan spread ρ should be viewed as encapsulating both a directly measurable higher rate but also the shadow cost of non-price rationing at the intensive or extensive margin, cf. Mabille and Wang (2022).

[19]Note that x_0 depends on firms’ *real* borrowing costs. We write ρ as a function of the real rate R_0, but what matters for deposit outflows and credit crunches is the *nominal* interest rate as Regulation Q applied to nominal deposit rates.

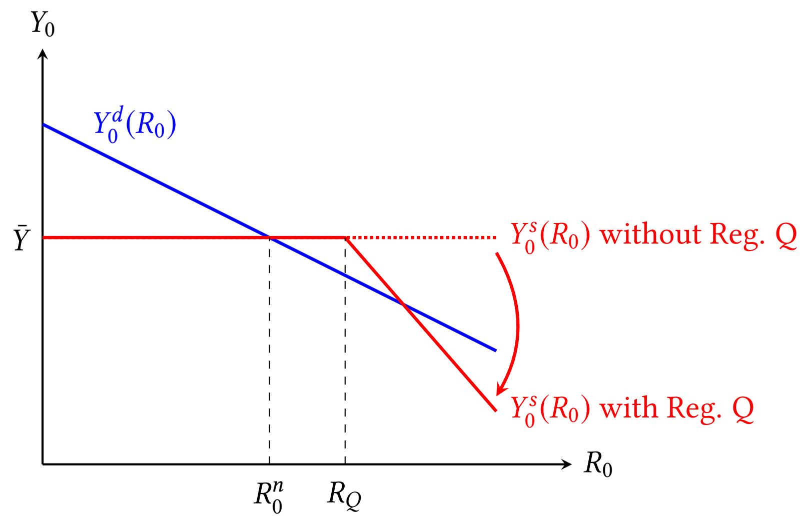

Figure A.3: Aggregate demand Y_0^d and aggregate supply Y_0^s as functions of R_0 with and without Regulation Q, where R_Q is the rate above which a binding Regulation Q triggers credit crunches. The dotted lines correspond to the frictionless New Keynesian model ($\nu = 0$).

even though it would be deflationary with a low enough ρ'. Figure A.3 shows how in this case aggregate supply becomes even steeper as a function of R_0 (i.e., has a more negative slope) than aggregate demand, due to the possibility of credit crunches. Thus Regulation Q may have amplified the supply consequences of tight monetary policy that we argue are always present when firms face liquidity constraints.

In this extreme case, a rate cut would actually lead to both higher output and less inflation, and thus lowering rates to $R_0 = R_0^n$ in Figure A.3 would be an improvement on both dimensions.[20] By contrast, in our model the central bank still faces the standard tradeoff between inflation and economic activity, and taming inflation requires increasing rates (as in Proposition 5). Moreover, unlike financial dominance that works through general equilibrium and dynamic effects, here the relevant kink in the Phillips curve is at an exogenous location determined by the Regulation Q cap, and not a function of past corporate leverage decisions.

[20]In case of a simultaneous positive demand shock making it impossible to stabilize inflation completely, the optimal rate would be $R_0 = R_Q$.

A.6 Convenience yield on debt

Suppose corporate debt enters households' utility function

$$\sum_t \beta^t \left(\log C_t - \chi N_t + v(D_t)\right), \tag{A.7}$$

where D_t is the value of corporate debt held at t.

Then we can solve for the flex-price production and capital-structure decisions of firms using only optimal labor supply by households, solving in particular for the capital structure as a function of R_t and R_t^E as we currently do:

$$x^*_{t+1} = \min\left\{1, \frac{\bar{x}}{\left(R_t^E/R_t\right)^{\frac{1}{1-\nu}}}\right\}. \tag{A.8}$$

The Euler equations for equity and debt are respectively

$$\frac{1}{C_t} = \frac{\beta R_t^E}{C_{t+1}}, \tag{A.9}$$

$$\frac{1}{C_t} = \frac{\beta R_t}{C_{t+1}} + v'(D_t). \tag{A.10}$$

Combining them and using market clearing, we obtain

$$C_{t+1} = \bar{Y}\min\left\{1, \bar{x}^\nu\left(\frac{R_t^E}{R_t}\right)^{\frac{-\nu}{1-\nu}}\right\},\ D_t = K(l_t + \gamma x_t) \tag{A.11}$$

hence

$$\frac{R_t^E}{R_t} = 1 + \frac{\bar{Y}\min\left\{1, \bar{x}^\nu\left(\frac{R_t^E}{R_t}\right)^{\frac{-\nu}{1-\nu}}\right\}}{\beta R_t}$$
$$\times\, v'\left(K\left[-R_{t-1}l_{t-1} + \frac{1}{R_t}\left(\frac{1}{R_{t+1}} + 1 - \gamma\min\left\{1, \bar{x}\left(\frac{R_t^E}{R_t}\right)^{\frac{-1}{1-\nu}}\right\}\right)\right]\right). \tag{A.12}$$

The right-hand side is decreasing in R_t^E/R_t, and also in R_t as soon as, e.g., v_t has a relative risk aversion smaller than 1. In this case we have that R_t^E/R_t and leverage decreases in R_t.

In the New Keynesian version of the model, we consider the tractable special case with linear utility of debt $v \cdot D_t$, with slope $v > 0$. In this case, we can easily compute the threshold

R^{MT} below which future leverage negatively affects future and thus current demand:

$$R^{MT} = \frac{v\bar{Y}}{\beta(\bar{x}^{1-\nu} - 1)}, \tag{A.13}$$

and monetary easing below this threshold yields the following relations between x_{t+1} and R_t and between Y_t and Y_{t+1}:

$$\frac{R_t^E}{R_t} = 1 + \frac{v\bar{Y} \min\left\{1, \bar{x}^{\nu}\left(\frac{R_t^E}{R_t}\right)^{\frac{-\nu}{1-\nu}}\right\}}{\beta R_t}$$

hence

$$\frac{R_t^E}{R_t} = 1 + \frac{v\bar{Y}}{\beta R_t}$$

for $R_t \geq R^{MT}$ or

$$\frac{R_t^E}{R_t} = 1 + \left(\frac{R_t^E}{R_t}\right)^{\frac{-\nu}{1-\nu}} \frac{v\bar{Y}\bar{x}^{\nu}}{\beta R_t}$$

for $R_t < R^{MT}$.

For $R_t < R^{MT}$, denoting $R_t^E/R_t = g(R_t)$, the equilibrium condition becomes

$$g(R_t) = 1 + g(R_t)^{-\nu/(1-\nu)} \frac{v\bar{Y}\bar{x}^{\nu}}{\beta R_t}. \tag{A.14}$$

To compute the interest-rate elasticity, implicitly differentiate (A.14):

$$g'(R_t) = \frac{-\nu}{1-\nu} g(R_t)^{-\frac{1}{(1-\nu)}} g'(R_t) \frac{v\bar{Y}\bar{x}^{\nu}}{\beta R_t} - g(R_t)^{-\nu/(1-\nu)} \frac{v\bar{Y}\bar{x}^{\nu}}{\beta R_t^2}.$$

Hence the interest-rate elasticity of output in this region is:

$$-\frac{d \log Y_0}{d \log R_0} = \frac{1}{1 + \frac{\nu}{1-\nu} \cdot \frac{\eta_g}{1 + \frac{1}{1-\nu}\left[\frac{R_t^E}{R_t} - 1\right]}},$$

confirming that market timing attenuates the output response to monetary policy.

A.7 Adverse selection and underwriting costs

There is a continuum with mass $1/q$ of desirable varieties, where $q \in (0, 1)$. At date t, there are $1/q$ firms standing ready to produce one variety each at $t+1$. Each firm will actually be able to produce at $t+1$ with probability q only, whereas with probability $1-q$ it cannot. For example firms draw independently one of two values for γ, one is sufficiently small and the other arbitrarily large. There is no private information at date t so firms can issue equity, the only difference with the baseline model is that each firm produces cash flows only with probability q. At the outset of $t+1$, at the refinancing stage, each firm privately observes whether it can produce. This creates adverse selection and a market breakdown in equity markets at this refinancing stage if q is sufficiently small.

Here we microfound the decreasing relationship between the interest rate and the debt-equity spread as an equilibrium consequence of increasing returns to scale in equity underwriting. Suppose that a monopolistic financial institution underwrites firms' equity. Its cost function is $C + c(1 - l_t)$ where $C,\ c > 0$, and it thus displays economies of scale. The underwriter collects a fee—a fraction f_t of issuance proceeds—that each firm takes as given. Let $\sigma_t \equiv f_t/(1 - f_t) = R_t^E/R_t - 1$. Suppose the financial institution is a contestable monopoly and so it must price at average cost. The equilibrium (σ_t, l_t) is then given by the underwriter's zero-profit pricing:

$$\sigma_t = c + \frac{C}{1 - l_t} \tag{A.15}$$

$$\Leftrightarrow \quad l_t = 1 - \frac{C}{\sigma_t - c} \tag{A.16}$$

and by firms' optimal capital structure decisions:

$$l_t = \frac{1}{R_t}\left(\frac{1}{R_{t+1}} - \gamma \min\left(\bar{x}(1 + \sigma_t)^{\frac{-1}{1-\nu}}, 1\right)\right). \tag{A.17}$$

At date 0, when monetary policy determines R_0 and aggregate demand, one has

$$\frac{1}{R_0 R_1} = \frac{\beta^2 Y_0}{\bar{Y}} = \frac{\beta}{R_0} \min\left(\bar{x}^{\nu}(1 + \sigma_0)^{\frac{-\nu}{1-\nu}}, 1\right), \tag{A.18}$$

and so (σ_0, l_0) solves

$$l_0 = 1 - \frac{C}{\sigma_0 - c}, \tag{A.19}$$

$$l_0 = \frac{1}{R_0}\left[\beta \min\left(\bar{x}^{\nu}(1+\sigma_0)^{\frac{-\nu}{1-\nu}}, 1\right) - \gamma \min\left(\bar{x}(1+\sigma_0)^{\frac{-1}{1-\nu}}, 1\right)\right]. \tag{A.20}$$

Suppose that the r.h.s. of (A.20) is in $(0,1)$ for $R_0 = \beta$ and $\sigma_0 = c$, then for C sufficiently small and R_0 sufficiently close to $1/\beta$, {(A.20),(A.19)} admits a solution $(\sigma_0, l_0) \in (c, +\infty) \times (0,1)$ that decreases in R_0, implying that date-0 monetary easing raises the debt-equity spread and reduces date-1 debt capacity.

A.8 More general elasticity of intertemporal substitution

Here we sketch how the results extend to the case in which households derive a more general CRRA utility over consumption $\frac{C^{1-1/\sigma}}{1-1/\sigma}$ where σ is the elasticity of intertemporal substitution (EIS).

First, the output in the flexible-price case (given the steady-state labor subsidy $\tau = 1/\epsilon$) becomes

$$Y_{t+1} = x_{t+1}^{\frac{\nu\sigma}{\sigma\alpha+1-\alpha}} \bar{Y}, \tag{A.21}$$

with

$$\bar{Y} = \left[AK^{\alpha}\left(\frac{1-\alpha}{\chi}\right)^{1-\alpha}\right]^{\frac{\sigma}{\sigma\alpha+1-\alpha}}.$$

Denote

$$\tilde{\nu} = \nu\frac{\sigma}{\sigma\alpha+1-\alpha}.$$

Then the date-$t+1$ capacity x_{t+1} becomes

$$x_{t+1} = \min\left\{1, \frac{\bar{x}}{\left(1+\frac{\kappa_t}{R_t}\right)^{\frac{1}{1-\tilde{\nu}}}}\right\} \tag{A.22}$$

where $\bar{x}^{\frac{\sigma\alpha+1-\alpha}{\sigma}} = \left(\frac{\nu}{\gamma}\right)^{\frac{\sigma\alpha+1-\alpha}{\sigma}} \left(\frac{1-\alpha}{\chi}\right)^{1-\alpha} AK^{-\frac{1-\alpha}{\sigma}}$.

The date-0 Euler equation becomes

$$Y_0 = \frac{x_1^{\tilde{\nu}} \bar{Y}}{(\beta R_0)^\sigma} \tag{A.23}$$

hence the interest-elasticity of output is

$$-\frac{d \log Y_0}{d \log R_0} = \begin{cases} \sigma \left[1 - \frac{\nu\kappa}{[1-\alpha+\sigma(\alpha-\nu)](R_0+\kappa)}\right] & \text{if } R_0 < R^{MT} \\ \sigma & \text{if } R_0 > R^{MT} \end{cases}$$

Finally, the date-0 Phillips curve becomes

$$\frac{P_0}{P_{-1}} = \left[\frac{1 - \lambda \left[x_0^{\nu} \left(\frac{\bar{Y}}{Y_0} \right)^{\frac{\sigma\alpha+1-\alpha}{\sigma}} \right]^{\phi(\epsilon-1)}}{1-\lambda} \right]^{\frac{1}{\epsilon-1}}. \tag{A.24}$$

Overall, a higher EIS implies that monetary policy affects supply relatively more than demand, all else equal.

A.9 Macroprudential policy

The market-timing channel implies an *aggregate supply externality*: each firm privately values low rates because they make debt cheap relative to equity, but collectively this reduces next period's aggregate capacity x_1 and thereby worsens the stabilization problem faced by monetary policy. A natural macroprudential tool is a tax or wedge on debt issuance at date 0, $\tau_F \geq 0$, that effectively raises the private cost of debt to $(1 + \tau_F)R_0$ without changing the intertemporal price faced by households.

Suppose a policymaker can complement the policy rate R_0 with a proportional wedge $\tau_F \geq 0$ on new debt issuance at $t = 0$ (e.g., a tax on debt-financed payouts). One unit of debt financing then effectively costs $(1 + \tau_F)R_0$, while the required return on equity remains R_0^E. This is equivalent to replacing the private debt cost R_0 by $(1 + \tau_F)R_0$ in the firm's choice. In particular, in the market-timing region, the optimal continuation scale becomes

$$x_1^* = \min\left\{1,\ \bar{x} \left(\frac{(1+\tau_F)R_0}{R_0^E} \right)^{\frac{1}{1-\nu}} \right\}. \tag{A.25}$$

The wedge τ_F directly targets the externality by discouraging privately optimal leverage that reduces x_1.

Consider the additive specification

$$R_0^E = R_0 + \kappa.$$

If κ is a pure transfer (so that the only welfare effect of market timing is through x_1), the constrained-efficient policy sets $x_1 = 1$ and eliminates the prudential motive from monetary policy. Concretely, for any given policy rate R_0 in the market-timing region, the policymaker can pick τ_F so that (A.25) delivers $x_1 = 1$:

$$1 + \tau_F = \frac{1 + \kappa/R_0}{\bar{x}^{1-\nu}}.$$

Conditional on this choice, the Ramsey-optimal monetary policy coincides with the stabilization policy for the date-0 demand shock (i.e., it closes the contemporaneous output gap) and no prudential distortion as in Proposition 6 is required.

If debt has a direct social value (e.g. a convenience-yield interpretation of κ), then τ_0 affects welfare both by changing x_1 and by changing the socially valuable quantity of debt. In that case, the macroprudential authority faces its own tradeoff and full separation need not obtain; nevertheless, the same logic implies that the targeted instrument is the appropriate margin to manage the intertemporal financial-stability externality, while the policy rate should focus primarily on contemporaneous stabilization.

The aggregate supply externality parallels the aggregate demand externalities in Farhi and Werning (2016), who show that individual borrowing decisions can be socially excessive when they do not internalize effects on future aggregate demand. The key difference is that our externality operates through aggregate *supply*. When firms increase leverage, they reduce future productive capacity, which cannot be offset by monetary policy once prices become flexible. This supply-side channel implies that the case for macroprudential policy does not depend on zero lower bound (ZLB) concerns. Even if the central bank remains unconstrained in its future choice of policy rates, it cannot force financially constrained firms to expand supply beyond what is feasible given their balance sheets. This is why the intertemporal tradeoff can arise even away from the ZLB.

A.10 Heterogeneous firms and reallocation

This appendix extends the ex-post analysis of the baseline model by allowing firms to be heterogeneous in (i) productivity A_i and (ii) inherited debt $F_{i,t-1}$, taken as given, while preserving CES demand and therefore constant desired markups.

Environment with heterogeneous firms. Varieties $i \in [0,1]$ are produced by firms with idiosyncratic productivity $A_i > 0$ and inherited debt face value per unit of capital $F_{i,t-1} \geq 0$. The production function at date t is

$$Y_{i,t} = A_i \, x_{i,t}^{\nu} K^{\alpha} N_{i,t}^{1-\alpha},$$

with the same (α, ν, K) as in the main text. We maintain Assumption 1 for all firms (so firms choose the maximal continuation scale subject to constraints). We also keep the deterministic reinvestment need γ as in the main text.

At date t, the policy rate is R_t. Each firm's continuation scale is determined by the same constraint as in equation (9) of the main text:

$$x_{i,t} = \min\left\{1,\ \frac{1}{\gamma}\left(\frac{1}{R_t} - F_{i,t-1}\right)\right\}. \tag{A.26}$$

We focus on parameter regions such that $1/R_t > F_{i,t-1}$ for all i so that all firms continue operating. Finally, we simplify expressions by setting the labor subsidy to $\tau = 1/\epsilon$ as in the main text to offset the steady-state monopoly distortion.

Natural output. We first characterize the flexible-price allocation and in particular natural output Y_t^n for a given cross-sectional state $\{(A_i, F_{i,t-1})\}_{i\in[0,1]}$ and interest rate R_t. Define the firm-specific analogue of potential output

$$\bar{Y}_i = A_i K^{\alpha} \left(\frac{1-\alpha}{\chi}\right)^{1-\alpha}, \tag{A.27}$$

which increases with productivity A_i.

Let $\phi \equiv 1/(1 + (\epsilon - 1)\alpha)$ as in Lemma 1. The optimal relative price of variety i satisfies

$$p_{i,t}^{*} = \left(\frac{Y_t^n}{x_{i,t}^{\nu} \bar{Y}_i}\right)^{\phi}, \tag{A.28}$$

where $x_{i,t}$ is given by (A.26).

Aggregate natural output is the CES aggregate

$$Y_t^n = \left(\int_0^1 \left(x_{i,t}^{\nu} \bar{Y}_i \right)^{\phi(\epsilon-1)} di \right)^{\frac{1}{\phi(\epsilon-1)}}. \tag{A.29}$$

In particular, absent financial constraints ($x_{i,t} = 1$ for all i), natural output is

$$\bar{Y} \equiv \left(\int_0^1 \bar{Y}_i^{\phi(\epsilon-1)} di \right)^{\frac{1}{\phi(\epsilon-1)}},$$

and the ratio $Y_t^n / \bar{Y}$ summarizes how heterogeneous financial constraints reduce aggregate supply through both average scale and composition effects.

Interest-rate sensitivity and the role of reallocation. Equation (A.29) shows that even under constant markups (CES demand), monetary policy can have a reallocation component on the supply side: a change in R_t affects $x_{i,t}$ heterogeneously through inherited debt $F_{i,t-1}$, which affects marginal costs and therefore relative prices and expenditure shares.[21]

Define the expenditure share of firm i under flexible prices as

$$s_{i,t} \equiv p_{i,t}^{1-\epsilon}. \tag{A.30}$$

where $p_{i,t} = P_{i,t}/P_t$. Using (A.28) and (A.29), these shares admit the closed form

$$s_{i,t} = \frac{\left(x_{i,t}^{\nu} \bar{Y}_i \right)^{\phi(\epsilon-1)}}{\int_0^1 \left(x_{j,t}^{\nu} \bar{Y}_j \right)^{\phi(\epsilon-1)} dj}. \tag{A.31}$$

Then

$$\frac{d \log Y_t^n}{d \log R_t} = \nu \int_0^1 s_{i,t} \frac{d \log x_{i,t}}{d \log R_t} di, \tag{A.32}$$

where $s_{i,t}$ is given by (A.31). Moreover, for firms with binding constraints ($x_{i,t} < 1$ or equivalently $F_{i,t-1} > \frac{1}{R_t} - \gamma$), we have

$$\frac{d \log x_{i,t}}{d \log R_t} = -\frac{1}{1 - F_{i,t-1} R_t}, \tag{A.33}$$

[21] Here we assume that firms' production functions only differ through A_i, but heterogeneity in other parameters ν_i or γ_i could also generate different interest-rate sensitivities.

while for unconstrained firms ($x_{i,t} = 1$ or $F_{i,t-1} < \frac{1}{R_t} - \gamma$), $d \log x_{i,t} / d \log R_t = 0$. Therefore,

$$\frac{d \log Y_t^n}{d \log R_t} = -\nu \int_{F_{i,t-1} > \frac{1}{R_t} - \gamma} \frac{s_{i,t}}{1 - F_{i,t-1} R_t} \, dH(A_i, F_{i,t-1}) \ \leq 0. \tag{A.34}$$

where we assume that the set of marginal firms around $F_{i,t-1} = 1/R_t - \gamma$ has measure zero (e.g., if the distribution of $F_{i,t-1}$ has no mass points).

Expression (A.34) shows how the aggregate supply effect of tightening depends on the distribution of leverage among constrained firms. Define

$$Z_{i,t} = \left(x_{i,t}^{\nu} \bar{Y}_i \right)^{\phi(\epsilon - 1)},$$
$$\delta_{i,t} \equiv \mathbf{1}\{F_{i,t-1} > 1/R_t - \gamma\} \frac{1}{1 - F_{i,t-1} R_t}$$

which both depend on R_t. $Z_{i,t}$ is a measure of effective productivity while $\delta_{i,t}$ increases with outstanding debt $F_{i,t-1}$.

Then (A.34) can be written as

$$\frac{d \log Y_t^n}{d \log R_t} = -\nu \left(\mathbf{E}[\delta_{i,t}] + \frac{\mathrm{Cov}(Z_{i,t}, \delta_{i,t})}{\mathbf{E}[Z_{i,t}]} \right). \tag{A.35}$$

The covariance term in (A.35) is the "reallocation" component: it is positive when firms that contribute more to aggregate output under flexible prices (i.e., high effective productivity $Z_{i,t}$) are also more interest-rate sensitive (high $\delta_{i,t}$, i.e., more indebted among constrained firms). In that case, tightening reduces aggregate supply more sharply than what would be implied by the average leverage.

The exact sufficient statistic in (A.35) is $\mathrm{Cov}(Z_{i,t}, \delta_{i,t})$. In the constrained region where $x_{i,t} < 1$ and for small cross-sectional dispersion in $F_{i,t-1}$ around its mean $\bar{F}_{t-1}$, we have the following first-order approximation of $x_{i,t}$ around the average $\bar{x}_t = \left(1/R_t - \bar{F}_{t-1}\right)/\gamma$:

$$x_{i,t} \approx \bar{x}_t - \frac{1}{\gamma}(F_{i,t-1} - \bar{F}_{t-1}).$$

Under this approximation, the reallocation term in (A.35) is proportional to

$$\mathrm{Cov}\left(A_i^{\phi(\epsilon-1)}, F_{i,t-1} \right).$$

Therefore, when more productive firms are more indebted, aggregate natural output is lower for a given R_t and its contraction under tightening is amplified; conversely, if high-productivity firms are less indebted, the aggregate supply contraction is mitigated.

B Proofs

B.1 Proof of Lemma 1

Nominal profits are given by

$$\begin{aligned} P_{t+1}\Pi_{i,t+1} &= P_{i,t+1}Y_{i,t+1} - (1-\tau)W_{t+1}N_{i,t+1} \\ &= P_{i,t+1}Y_{t+1}\left(\frac{P_{i,t+1}}{P_{t+1}}\right)^{-\epsilon} - \frac{(1-\tau)W_{t+1}}{x_{i,t+1}^{\frac{\nu}{1-\alpha}}K^{\frac{\alpha}{1-\alpha}}}\left[\frac{Y_{t+1}}{A}\left(\frac{P_{i,t+1}}{P_{t+1}}\right)^{-\epsilon}\right]^{\frac{1}{1-\alpha}} \\ &= P_{t+1}Y_{t+1}\left[\left(\frac{P_{i,t+1}}{P_{t+1}}\right)^{1-\epsilon} - (1-\tau)\frac{W_{t+1}/P_{t+1}\,Y_{t+1}^{\frac{\alpha}{1-\alpha}}}{x_{i,t+1}^{\frac{\nu}{1-\alpha}}K^{\frac{\alpha}{1-\alpha}}}A^{\frac{-1}{1-\alpha}}\left(\frac{P_{i,t+1}}{P_{t+1}}\right)^{-\frac{\epsilon}{1-\alpha}}\right]. \end{aligned}$$

The optimal price $P^*_{i,t+1}$ in (5) follows from the first-order condition and using (4) and the market clearing condition for output $C_{t+1} = Y_{t+1}$ to rewrite the real wage as $W_{t+1}/P_{t+1} = \chi Y_{t+1}$.

B.2 Proof of Proposition 3

Suppose first that we are in a case such that the ex-ante leverage $\ell_{i,t}$ implies full continuation $x_{i,t+1} = 1$ at date-$t+1$. Then the firm maximizes

$$\left[\Pi_{i,t+1}(1) - \gamma K\right] + \left[R_t^E - R_t\right]\ell_{i,t}K$$

which is highest when $\ell_{i,t} = \bar{\ell}_t$ if $R_t^E > R_t$, and is independent of $\ell_{i,t}$ if $R_t^E = R_t$. Therefore without loss of generality we can restrict attention to leverage choices $\ell_{i,t} \in [\bar{\ell}_t, 1]$.

Conversely, suppose that we are in an case such that the optimal leverage $\ell_{i,t}$ implies an interior continuation scale $x_{i,t+1} < 1$. Then we can substitute

$$R_t\ell_{i,t} = \frac{1}{R_{t+1}} - \gamma x_{i,t+1}$$

to rewrite the firm's objective function as a function of $x_{i,t+1}$

$$\Pi_{i,t+1}(x_{i,t+1}) - x_{i,t+1}\frac{R_t^E}{R_t}\gamma K.$$

The first-order condition with respect to $x_{i,t+1}$ is

$$\begin{aligned}\frac{R_t^E}{R_t}\gamma K &= \frac{\partial \Pi_{i,t+1}}{\partial x_{i,t+1}} \\ &= (1-\tau)\frac{\nu}{1-\alpha}A^{\frac{-1}{1-\alpha}}x_{i,t+1}^{-\frac{1+\nu-\alpha}{1-\alpha}}\frac{\chi Y_{t+1}^{\frac{2-\alpha}{1-\alpha}}}{K^{\frac{\alpha}{1-\alpha}}}\end{aligned}$$

from the envelope theorem, given optimal pricing. With symmetric firms such that $x_{i,t+1} = x_{t+1}$, we can then replace aggregate output $Y_{t+1} = x_{t+1}^{\nu}\bar{Y}$ to get the optimal choice of future continuation:

$$x_{t+1}^* = \bar{x}\left(\frac{R_t}{R_t^E}\right)^{\frac{1}{1-\nu}}, \tag{A.36}$$

where

$$\bar{x} = \left[(1-\tau)\frac{\nu\bar{Y}}{\gamma K}\right]^{\frac{1}{1-\nu}}.$$

is higher than 1 by Assumption 1. If (A.36) implies $x_{t+1}^* < 1$, then this is the optimum, since by concavity this dominates $x_{t+1} = 1$.

B.3 Proof of Proposition 5

In the relevant region $x_0 < 1$, solving (12) corresponds to finding a zero for the function $\zeta(R_0) = R_0^{\frac{1}{\nu}-1} - R_0^{\frac{1}{\nu}}F_{-1} - \gamma\beta_0^{-\frac{1}{\nu}}$, which is negative at $R_0 = 1/\beta_0$ and maximized at

$$R_0 = \frac{(1-\nu)}{F_{-1}}.$$

Therefore, ζ is always negative if its maximum is negative, i.e. if

$$\beta_0 < \underline{\beta}(F_{-1}) = \left(\frac{\gamma}{\nu}\right)^{\nu}\left(\frac{F_{-1}}{1-\nu}\right)^{1-\nu} \tag{A.37}$$

which is increasing in outstanding debt F_{-1}.

B.4 Proof of Proposition 2

Fix F_{-1} and shut down market timing by taking $x_1 \equiv 1$. Then $C_1 = \bar{Y}$ and the date-0 Euler equation yields

$$C_0 = Y_0 = \frac{\bar{Y}}{\beta_0 R_0}.$$

The continuation scale is

$$x_0(R_0, F_{-1}) = \min\left\{1,\ \frac{1}{\gamma}\left(\frac{1}{R_0} - F_{-1}\right)\right\},$$

and the date-0 output gap is

$$G_0(R_0, F_{-1}) = \frac{Y_0}{x_0(R_0, F_{-1})^{\nu}\bar{Y}} = \frac{1}{\beta_0 R_0\, x_0(R_0, F_{-1})^{\nu}}.$$

Welfare (up to constants) is $W_0(R_0; F_{-1}) = \log C_0 - \chi N(G_0)$.

Unconstrained region $R_0 \le \bar{R}(F_{-1})$. If $R_0 \le \bar{R}(F_{-1}) \equiv (\gamma + F_{-1})^{-1}$, then $x_0 = 1$ and $G_0 = 1/(\beta_0 R_0)$. Differentiating with respect to $\log R_0$ gives

$$\frac{d\log C_0}{d\log R_0} = -1, \qquad \frac{dG_0}{d\log R_0} = -G_0.$$

Hence

$$\frac{dW_0}{d\log R_0} = -1 + \chi N'(G_0)G_0 = -1 + M(G_0),$$

so the interior FOC is $M(G_0) = 1$.

Constrained region $R_0 > \bar{R}(F_{-1})$. If $R_0 > \bar{R}(F_{-1})$, then

$$x_0 = \frac{1 - F_{-1}R_0}{\gamma R_0}.$$

Thus

$$\frac{d\log x_0}{d\log R_0} = -\frac{1}{1 - F_{-1}R_0}$$

$$\frac{d\log G_0}{d\log R_0} = -1 - \nu\frac{d\log x_0}{d\log R_0} = -1 + \frac{\nu}{1 - F_{-1}R_0}.$$

Therefore

$$\frac{dW_0}{d\log R_0} = -1 - \chi\mathcal{N}'(G_0)\frac{dG_0}{d\log R_0} = -1 + M(G_0)\left(1 - \frac{\nu}{1 - F_{-1}R_0}\right),$$

so the interior FOC is

$$M(G_0)\left(1 - \frac{\nu}{1 - F_{-1}R_0}\right) = 1.$$

Optimality of the kink $R_0 = \bar{R}(F_{-1})$. Let $G_k \equiv G_0(\bar{R}(F_{-1}), F_{-1}) = 1/(\beta_0\bar{R}(F_{-1}))$. The left- and right-derivatives of W_0 with respect to $\log R_0$ at the kink are

$$\left.\frac{dW_0}{d\log R_0}\right|_{-} = -1 + M(G_k), \qquad \left.\frac{dW_0}{d\log R_0}\right|_{+} = -1 + M(G_k)\left(1 - \frac{\nu}{1 - F_{-1}\bar{R}(F_{-1})}\right).$$

Therefore a sufficient condition for the kink $\bar{R}$ to be optimal is

$$M(G_k) \geq 1, \qquad M(G_k)\left(1 - \frac{\nu}{1 - F_{-1}\bar{R}(F_{-1})}\right) \leq 1.$$

B.5 Proof of Proposition 6

Assume $x_0 = 1$ (no current supply constraint) but $x_1 = x_1(R_0)$ (market timing affects future supply). Then

$$C_1 = x_1(R_0)^{\nu}\bar{Y}, \qquad C_0 = \frac{C_1}{\beta_0 R_0} = \frac{x_1(R_0)^{\nu}\bar{Y}}{\beta_0 R_0}, \qquad G_0(R_0) = \frac{Y_0}{\bar{Y}} = \frac{x_1(R_0)^{\nu}}{\beta_0 R_0}.$$

Welfare is

$$W(R_0) = \log C_0 - \chi\mathcal{N}(G_0(R_0)) + \beta_0 \log C_1.$$

Then

$$\frac{dW}{dR_0} = (1+\beta_0)\nu\frac{x_1'(R_0)}{x_1(R_0)} - \frac{1}{R_0} - \chi\mathcal{N}'(G_0)\frac{dG_0}{dR_0}.$$

Since $G_0 = x_1^{\nu}/(\beta_0 R_0)$, we have

$$\frac{1}{G_0}\frac{dG_0}{dR_0} = \nu\frac{x_1'}{x_1} - \frac{1}{R_0} \quad \Rightarrow \quad \frac{dG_0}{dR_0} = G_0\left(\nu\frac{x_1'}{x_1} - \frac{1}{R_0}\right).$$

Using $M(G) = \chi\mathcal{N}'(G)G$, we obtain the compact expression

$$\frac{dW}{dR_0} = \frac{M(G_0) - 1}{R_0} + \nu\frac{x_1'}{x_1}\Big(1 + \beta_0 - M(G_0)\Big).$$

The natural rate R_0^n is defined as satisfying $G_0(R_0^n) = 1$. At R_0^n we have $G_0 = 1$ and therefore $M(G_0) = M(1) = 1$. Therefore

$$\left.\frac{dW}{dR_0}\right|_{R_0=R_0^n} = \nu\,\frac{x_1'(R_0^n)}{x_1(R_0^n)}\,\beta_0.$$

In the market-timing region $x_1'(R_0^n) > 0$, so the derivative is strictly positive. Hence welfare is increasing in R_0 at R_0^n, implying $R_0^{opt} > R_0^n$.